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DICKENS AND THACKERAY.

BY RICHARD A. PROCTOR.

MR. THURLOW WEED, the American politician, once expressed surprise at the circumstance that in England Dickens does not seem to be at present held in such high esteem as in America. He remarked that, to him, there seemed no comparison between Thackeray and Dickens, so far at least as their power of enchaining the attention was concerned. I propose to point out some considerations which appear to me to justify the opinion which is now generally entertained in England respecting Dickens' writings. It also should, however, be understood that those who recognise most clearly the shortcomings of Dickens even as a humourist (using this word in the wide sense in which Thackeray has employed it in his lectures on writers of the last century), feel too deeply the debt of gratitude the world owes to Dickens to desire in any way to be-little a name which men will always hold in high esteem.

It may be convenient, though there are objections to such a course, to follow Mr. Thurlow Weed in making comparison between Dickens and Thackeray. It will be noticed that though he says there is no comparison he, in that very remark, makes very definite comparison between the two writers. The practice of instituting such comparisons is not a pleasing one. We may praise or, if occasion arise, blame, a writer, a painter, a sculptor or a man of science, without inquiring whether he deserves more or less praise or blame than some other worker in his own line. I have noted cases where comparisons, unnecessarily introduced into criticisms, seem as though specially intended, as certainly they are calculated, to excite ill-will between the persons compared; and it would be well if a system of criticism were adopted from which all such comparisons should be rigidly excluded as mischievous and offensive. But in considering the work of two such writers as Dickens and Thackeray comparison can hardly be avoided, though often the study of their writings suggests rather contrast than comparison.

So far as the construction of their stories is concerned, neither Dickens nor Thackeray has shown special skill. But there is one marked difference between them in this respect: Thackeray deliberately rejected the old-fashioned method of constructing a plot. His stories are pictures from real life, and were meant to be such. He no more attempts artistic arrangement than Hogarth aimed at colour effects in his paintings. In fact, at times, when he finds his events moving toward an effective situation, Thackeray deliberately interrupts the current of his narrative to call attention to the opportunity thus offered for fine writing, of which, however, he refuses to avail himself. I could cite several instances, but will content myself by mentioning the scene where Philip Firmin breaks in upon the group of angry persons on Mme. Smolensk's staircase. "Here, I protest," he says, or to that effect—"here, I protest, is a fine situation," and he proceeds to sketch in the details; but in order rather to make a grotesque than an effective picture—though there are few passages more beautiful than the closing lines of that description.

With Dickens the case is altogether different. It is true that "Pickwick" was purposely written without any definite plot; but Dickens was then writing to order. In all his other stories he manifestly aimed at the construction of an attractive plot, after the old-fashioned manner, the story to come to a close with the marriage of the hero and heroine, the good characters to get their proper reward, the villains to be duly punished. He not only failed, but it is noteworthy that not one of his heroes or heroines, and scarcely one of his very good and very villainous characters is well painted. His heroes, indeed, are, for the most part, like that youth of the Chuzzlewit family, who had no outline, or rather they may be described as Mantalini described two of his imaginary conquests, of whom one "had no outline at all," and the other "had a demned outline." Clennam and Walter Gay are of the no outline sort; Nickleby, Harmon, and Chuzzlewit belong to the other category.

It is in fact in the presentation of character that the contrast between Thackeray and Dickens is most marked. It appears to me that Thackeray stands among the very first of our English writers in this respect, even if, so far as novel writing is concerned, he is not absolutely first, Macaulay would have set Jane Austen before Thackeray, because of the skill with which she delineated characters closely akin. But the range of Miss Austen's portraiture was so small compared with that of Thackeray's, that he must be set above her on this account alone, unless it could be shown that she would have been as successful on the large scale as she certainly was in the few cabinet pictures on which she exercised her powers.

I am particularly struck by Thackeray's skill in giving life and reality to his leading characters (we must not say heroes and heroines, since Thackeray tells us he knew of none and pretended to describe none), because it is in this that novelists chiefly fail. What a vague and shadowy set are Scott's heroes and most of his heroines, though it must be admitted that Rebecca, Di Vernon, and Julia Mannering are charmingly delineated. On the contrary, Esmond, the two Virginians, the other Warrington, Pendennis, Clive Newcome, Philip Firmin and dear old Dobbin—all these are men, not (like most of our story heroes) mere names tacked on to descriptions with which they do not in the least correspond.

But even more striking, though less generally recognised, or in general denied altogether, is Thackeray's power of portraying women. I find it perfectly amazing that so many deny Thackeray's power in this respect, where he is almost without a rival. Repeatedly we hear it said that he could only draw two sorts of women—Becky Sharpes

and Amelia Osbornes—apart, that is from subordinate characters.*

It is noteworthy that women hold this opinion; indeed, I am not sure that they are not chiefly responsible for the opinion that all Thackeray's amiable women are fools and all his clever women rogues. Yet no opinion could be much further from the truth. Theo and Hetty Lambert suffice as illustrations of Thackeray's power in delineating amiable women who are not fools and clever women who are not only not rogues, but of sweet and attractive dispositions.†

In Ethel Newcome we have the two qualities combined in still more marked degree. Surely, by the way, there is no more charming picture than that of Ethel Newcome, infinitely more attractive, with all her faults, than she would been without them, and without her noble and touching repentance.

(*To be continued.*)

THE YOUNG ELECTRICIAN.

By W. SLINGO.

(*Continued from p. 455.*)

HAVING, as I said a fortnight since, dealt with such tools and appliances as the tyro in experimental electricity is likely to require, I would now direct his attention to the experiments themselves.

One little word may here be uttered, and that is to repeat the old warning, that to succeed in any experimental science frequent practice and exercise are necessary. The reader may rest assured that no experiment will be detailed which cannot be repeated by anyone of ordinary skill and intelligence. Let it ever be remembered, however, that experimenting is an art which is not inborn, but which must be acquired.

Some of our readers would doubtless be best satisfied were I to at once enter into details concerning the construction of elaborate pieces of apparatus; but I am anxious not only to impart to this series of articles an air of completeness, but also to afford our younger constituents an opportunity of gaining an insight into the rudiments of experimental practice. Let us, then, in the first place, consider the

PRODUCTION OF ELECTRICITY BY FRICTION.

Pr. 1. When two bodies are rubbed one over the other, each body becomes electrified. As, however, electricity is only a "force" or condition into which "matter" is thrown, it is invisible, and its presence can only be detected by its results. Now the result of imparting electricity to, or of electrifying, a body, is to endow it with an attractive power over other bodies.

It will often be noticed that the greater the *physical* difference between the two bodies rubbed together, the greater will be the degree of electrification.

It will not always be easy to detect the presence of electricity in *both* bodies, so we will first perform a few experiments, with a view to obtaining a charge upon one of the bodies, ignoring the other.

In order to show the attractive power possessed by an electrified body, we require a few simple pieces of apparatus.

Ex. LXVII.—The first is a suspending support, such as that illustrated in Fig. 36, which consists of a wooden base, A B, 3 in. or 4 in. sq., and a piece of brass or copper wire, C D E, one-eighth to three-sixteenths of an inch in diameter, and about 2 ft. long bent approximately, to the shape shown, the end C being fixed in a hole in A B, made with a bradawl or gimlet, and the end E being bent upwards to receive a piece of cotton, silk, &c.

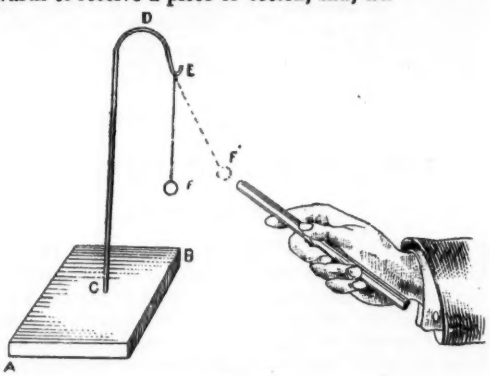


Fig. 36.

Ex. LXVIII.—Procure from a seller of watchmaker's sundries or elsewhere a few sticks of elder pith, and cut one or two of them into balls with a sharp penknife. When it is required to suspend these balls, run them through with a needle supplied with cotton or silk, according to requirements, securing the thread by making a neat knot. Cut off the thread as close to the knot as possible, leaving a foot or so of thread on the other side of the ball for suspending, as in Fig. 36.

Ex. LXIX.—Get, for a few pence, a book of Dutch metal at a picture-frame maker's, or elsewhere; abstract, by means of a clean knife, one of the sheets of metal, and place it between two pieces of note-paper; lay these on a piece of board, and with a sharp pen-knife cut into as many small pieces as possible. The use of the note-paper reduces considerably the risk of tearing the metal leaf.

Ex. LXX.—Pass a vulcanite comb through the hair (if dry) a few times, and then present or place it near to a small tuft of feathers, or a pith ball suspended by a piece of cotton or silk thread (Fig. 36). The feather or pith ball will be attracted by or drawn towards the comb, a phenomenon which did not ensue on presenting the comb prior to its being passed through the hair.

Ex. LXXI.—Rub a stick of warm sealing-wax, shellac, sulphur, or a wooden road coated with two or three layers of shellac varnish (Ex. I.), with a piece of hot flannel, or fur, or even on a dry coat-sleeve, and present it to the feather or pith-ball; attraction ensues, and the ball is drawn into the position F' Fig. 36.

* The only opinion I have heard of, which, in my judgment, compares with this in absurdity, is Thackeray's own opinion (expressed in one of his Brown letters) that all Shakespeare's heroines are alike. Macaulay, by the way, was of the same opinion, though I cannot at the moment recall any passage in his writings where he has said as much; but Mrs. Harriet Beecher Stowe mentions in her "Sunny Memories" that Macaulay expressed that opinion to her in conversation. She adds, if I remember rightly, that no woman would agree with him in that opinion, and I should imagine very few men would either, even though the opinion were modified into the view that Shakespeare's sprightlier heroines were all alike, and his gentler heroines also.

† Let not a hasty reader of the "Virginians" point out here that Jack Lambert says of Hetty that she is sometimes "harsh," for there cannot be a shadow of doubt that what Thackeray wrote, or at any rate intended to write, was "arch," as the context most plainly shows. By the way, he was a rather careless reader of proofs, for not very far from the passage in which this mistake occurs is another where the word "general" has been altered into "quarrel," and so stands in all the editions I have yet seen. "Did the General ever make you jealous?" George Warrington rather rudely asks of Mrs. General Lambert; but this has been altered into the absurd question, "Did the quarrel ever make you jealous?"

Ex. LXXII.—The electrified rod may be held over a quantity of bran, chopped straw, or Dutch metal cut in small pieces (Ex. LXIX.), and laid on the bare table or on a sheet of paper (Fig. 37). The small bodies will rise towards the rod. (They will subsequently be driven away or repelled, but of that more anon.)

Ex. LXXIII.—Another experiment is to balance a wooden lath (L, L′ Fig. 38) about, say, 3 ft. long, 1½ in. wide, and ¼ in. thick, on an egg-shell placed in an egg-cup, and then bring the electrified rod near one end of it; the lath may be very easily drawn round.

Fig. 37.

Ex. LXXIV.—Still another experiment is to balance an unrubbed *i.e.*, unelectrified, rod of sealing-wax, &c., in a suspended paper loop (Fig. 39), or in a carrier made by bending a piece of brass or copper-wire into the shape shown in Fig. 40, W being the wire, and R a piece of ribbon, by which it is suspended. Round the ends of the wire with a file, as nicely as possible; or, solder them together, afterwards rubbing down the superfluous solder, and shaping them into the form shown in Fig. 41. The suspended rod A B will be attracted by our electrified rod.

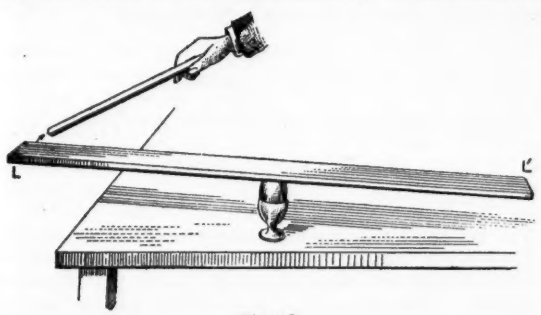


Fig. 38.

Ex. LXXV.—Hold the electrified rod over a person's head, the hair (presuming the head chosen is not a bald one) will be attracted, and assume a more or less erect position. Dry hair answers best. Some difficulty will, in all probability, be experienced if the hair is at all damp. Pass the rod over the face; a peculiar creeping sensation will be experienced, due to the attractive force exerted by the electricity.

Ex. LXXVI.—Place an egg-shell on a smooth, level table or board, and bring the electrified rod near it; it will be attracted, and if the rod be slowly withdrawn along the table the egg-shell will diligently and promptly trundle along after it.

Ex. LXXVII.—A similar experiment, but upon a larger scale, may be easily performed. Make a paper-drum, Fig. 42. To do this, cut a strip of stout cartridge-paper, about seven or eight inches wide and 19¼ in. long. Let the edges of the paper be square one with the other, and, taking one of the short edges, draw a line parallel with it, but within a quarter or three-eighths of an inch of the other short edge. Bend this strip round and gum the unmarked edge over the marked one, letting the former coincide with the line on the other. A good cylinder may be thus made.

Fig. 40.

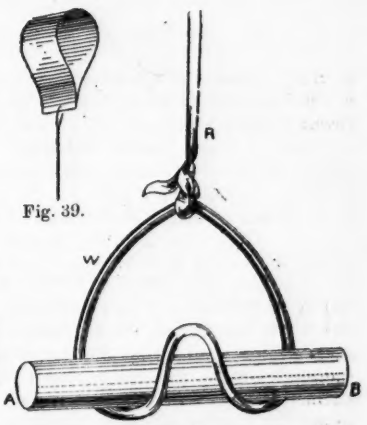


Fig. 41.

Fig. 39.

The awkward part about the job is to attach the ends of the drum. Cut two circular pieces of cartridge about 6½ in. in diameter, and describe from the centre of each a circle of 3-in. radius. A rim, a quarter of an inch wide, will thus be left round the paper outside the circle. With a pair of scissors make a series of cuts across this rim, at intervals of about half an inch. Gum the rim of one of the discs, lay the drum over it so that it will coincide (as it should do) with the circle, place a tumbler or any other convenient round substance inside the drum, and pass it in succession all round the lower edge, at the same time pressing up against it, piece by piece, the small sections of the rim. Properly attended to, a good drum-end (A, B) will result.

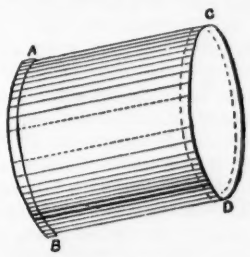


Fig. 42.

Now for the other end (C, D). It is manifest that as we cannot pass a tumbler or anything else round the inside, we cannot guide the rim round the outside of the paper drum. We may, however, easily fasten the disc on the inside of the drum. The rim having been duly cut, bend the pieces forming the rim upwards, so as to give the paper an appearance similar to that of the lid or cover of a round tin box. Now gum the outer side of the rim, insert the disc just inside the drum, and with the finger and thumb press the gummed outside of the rim against the inside edge of the drum. The drum will now be complete, so far as its manu-

facture is concerned. The smooth flush end first made may be painted in radial sections, or in any other way the young electrician may prefer.

Such a drum laid on a smooth level table may be made to roll along it with a comparatively feeble charge of electricity. Why this is, we can ascertain presently.

(To be continued.)

TO STRENGTHEN THE ARMS.

BY RICHARD A. PROCTOR.

I SET to work a few days since collecting together for publication, in book form, my papers on "How to Get Strong," which I supposed I had completed; but I found to my horror a rather serious omission. I had not written a word about the arms, except (which probably led to my forgetfulness in the matter) in giving many exercises for the arms where I was dealing directly with the chest, waist, loins, and legs. The arms, from the shoulders to the finger-tips, require to be dealt with separately; and I proceed to correct the omission, premising that the series of papers will shortly be published in collected form, in company with the papers on corpulence, corset compression, rowing, swimming, and exercise for middle and advanced life.

I may mention, in passing, that a railway accident in the summer of 1883 led in my own case to the interruption, for several months, of those exercises which I advocate as desirable to maintain the body in a healthy and active condition. All exercise was rendered painful by the jarring effects of that accident, especially in the region of the upper spine, and the base of the brain. It is only recently that I have felt "myself again" in this respect; and I can answer for it, from experience, that the interruption of systematic daily exercises, such as I have described in these columns, affects seriously, while it lasts, the capacity for other kinds of work.

It is commonly supposed that the exercises of which most Englishmen are fond, and especially rowing, develop the muscles of the arms and shoulders in greater degree than they develop the muscles of the body. This, however, is a mistake. As a rule, Englishmen are better in loins and legs than in shoulders and arms. Rowing in particular affords very insufficient exercise for the arms. Of course, many rowing men assert that rowing exercises every muscle of the body, an assertion which needs no contradiction, for, as Mr. Maclaren well says, no exercise gives more than employment for a portion of the body. Rowing in heavy boats gives exercise to the shoulders and arms, no doubt; but even in these the work falls more on the back, loins, and legs than on the arms, while in the lighter kinds of boats, and especially in racing boats, the forearm and upper triceps alone get any work worth considering, the biceps and the rest of the upper arm getting scarcely any work at all. The biceps will gain more from a week's steady work with the dumb-bells and the clubs than from a year of rowing; nay, so far as the shapeliness of the arm is concerned, rowing positively injures the biceps, by making it look relatively smaller than it had been before. Cricket and lawn-tennis give more exercise to the arms; but if too exclusively used, they destroy all symmetry. I never yet saw a cricketer of the very enthusiastic sort with well-shaped arms.

Let us now consider the arm in detail, from the shoulder to the hand.

THE SHOULDERS AND UPPER ARM.

For strengthening the shoulder muscles exercise with the clubs is invaluable. So are some of the pulling exercises already considered. But no apparatus of any sort is really necessary.

Standing upright, the arms hanging down, carry the arms from the sides forwards and upwards and then backwards as they pass down to a horizontal position, turning the palms of the hands upwards. Continuing the motion, let the arms be lowered to the sides till the hands strike the backs of the thighs. Repeat the process twenty or thirty times. You will soon feel that the muscles around the shoulder are doing good work and getting well limbered up. With dumb-bells the work is heavier, but if the dumb-bells are too heavy, the work is less effective in making the shoulder muscles quick and active. With clubs the centrifugal tendency is somewhat too marked, until the shoulder muscles have been strengthened by exercise without them; but later, this exercise with the clubs will be found excellent, and the slow lowering of the clubs from the horizontal position on each side, and rather backward, is particularly beneficial. In fact, in nearly all exercises with the clubs, slow movements of lowering and raising, while the clubs are held far out, are capital for strengthening and steadying the muscles of the upper arms and shoulders.

Next, standing upright, with the arms raised vertically, lower them steadily forwards till they are at the sides, forcibly continuing the motion till they have been carried as far back as they will go, keeping the body upright. Repeat this a score or so of times, each time holding the arms as far back as they can be carried, while you count ten slowly. You will find the muscles of the upper back near the shoulder considerably exercised even without lifting dumb-bells backwards in this way. But as you get accustomed to the work and it grows lighter, use dumb-bells, or any other convenient weights. To limber up the same muscles carry light clubs from over the head forwards downwards and so backwards, as far as they will go, keeping the body all the time rigidly upright.

(To be continued.)

THE PHILOSOPHY OF CLOTHING.

BY W. MATTIEU WILLIAMS.

X.—GASEOUS CLOTHING MATERIAL (*continued*).

IN my last I stated some examples of that adhesion of gaseous matter to solids which, as Rumford has shown, contributes such important aid to the efficacy of clothing. The subsequent progress of science has not only confirmed his conclusions, but has presented this agency as a still more potent factor than it appeared to be in his day, when the general subject of gaseous adhesion had received so little attention.

We now know that not only do gases remain obstinately adherent to solid surfaces, but that they are condensed thereon so powerfully as to become, in some cases, apparently liquefied and even solidified.

In the experiment with the blackened card described in my last, the solid which effected the atmospheric adhesion was carbon. The film of carbon and the film of adhering air in this case are both so small and light that the quantity of adhering gas is not practically weighable or measurable. By using carbon in larger quantity and of suitable form the amount of gas adhering to its surface may be easily measured. Charcoal is carbon in such a form, its porous structure providing a great extent of surface packed in

small compass. By plunging a piece of freshly-burnt charcoal into mercury while still red hot, and passing this when cooled into a jar of gas standing over mercury, the rise of the mercury measures the volume of gas absorbed by the charcoal.

Boxwood charcoal, thus treated, has been found to absorb 90 times its own bulk of ammonia, 85 of hydrochloric acid, 65 sulphurous acid, 55 sulphuretted hydrogen, 40 protoxide of nitrogen, 35 carbonic acid, 9·4 carbonic oxide, 9·2 oxygen, 7·5 nitrogen, 5·0 carburetted hydrogen, 1·7 hydrogen. In this case the ammonia and hydrochloric acid are condensed into a smaller bulk than they occupy when made liquid by mechanical pressure.

The adhesion of hydrogen to metals, and consequent condensation within their pores, is still more remarkable, especially as these pores require optical assistance to render them visible. Thus Graham pumped out of a piece of meteoric iron 2·85 times its own bulk of gases, of which 86 per cent. was hydrogen. This "occlusion" of hydrogen by some metals, notably by palladium, solidifies the hydrogen into metallic hydrogenium which forms an alloy with the palladium. The condensation in this case is enormous, the volume of hydrogen absorbed by the palladium being, under certain conditions, being 980 times greater than that of the palladium itself, the bulk of the solid increasing in accordance with the theory that the hydrogen has become a solid metal, and is alloyed with the palladium, and the properties of the solid are modified accordingly. The hydrogenium may be separated in its original form of gaseous hydrogen by simply heating the alloy.

We are still without data for determining the quantity of gas which is condensed upon the fibres of natural and artificial clothing material, and of its variation under different conditions; so far as I am able to learn, this subject has dropped out of sight since the publication of Rumford's essays. Modern physiologists have devoted themselves very industriously to the splitting of hairs and the examination of their microscopic structure and morphological relations, and generally to any and every other subject that is far fetched and pedantic, while they have sadly neglected those vulgar practical researches to which Rumford devoted himself. Now that I am upon this very practical subject of clothing, I find myself compelled to repeat what I have already said in reference to my previous subject of cookery, viz., that the whole amount which the science of the current century has directly added to the work of Rumford is so small as to be simply contemptible.

Certain irreverent outsiders reviewing the selection of candidates for Fellowship in the Royal Society have been wicked enough to describe that venerable association as an advertising agency for fashionable physicians. I will not express my own opinion on the general merits of its recent "Transactions," but must say that I am surprised at the infinitesimal amount of work that has been done by these numerous medical Fellows in following up the researches of Rumford, and the fact, clearly indicated by their published works, that they are generally ignorant of his contributions to the truly "Philosophical Transactions" of the Society. This, in spite of the fact that he left Bavaria, came to England, and resided in Brompton-road for the express purpose of republishing his useful scientific papers in convenient form for reference, which he did between 1796 and 1802. He also founded the Royal Institution for the purpose of disseminating a knowledge of these discoveries and inventions, and encouraging others to make similar researches in the region of practical philosophy.

In spite of this, his work died with him. Speculators would not patent his invention, nor pedants glorify themselves by further investigation of such vulgar subjects, and thus I find myself compelled to take them up just where he left them nearly a hundred years ago. He, by his original and unaided researches, showed that the natural clothing material of the warm-blooded animals that live out of water is practically a stratum of air held captive by the fibres of their hair or feathers, and that our artificial clothing is, or should be, so constructed as to provide us with a similar envelope, which, while it resists the transmission of heat from our bodies in the manner he explained, does not prevent the exhalations of the skin from passing through it.

These original experiments of Rumford were necessarily crude; he had not the instrumental advantages, the well-appointed laboratory, and skilled assistants that are now available; his researches demand repetition, correction, and extension, but have not received them. This applies not only to that part of the subject I have already treated—the relations of clothing to the temperature of the body, but also to another function of clothing yet to be treated—viz., the absorption of cutaneous exhalations. Here again I find that the only quantitative researches directly bearing on the subject and worth notice are those by Rumford.

Before taking up these, I must add that the import of his crude experiments has been increased by what we have subsequently learned in other fields of research, though their connection does not appear to have been noted.

Rumford only regarded the protective effectiveness of air in connection with non-conduction of heat and the interference of the fibres with its convective movements. The researches of Melloni and Tyndall on radiant heat have subsequently taught us that air, when saturated with the aqueous vapour, is an effective shield to radiation; that it is almost impenetrable to the radiations of obscure heat, such as those from the body. The law of exchanges, now so firmly established, further supplies us with the deduction that each particular hair is perpetually radiating heat towards the body; the more it receives from the body the more it returns towards it, and to its fellow-hairs or fibres. The efficacy of this is, however, practically minimised to a barely appreciable quantity by the resistance to obscure radiation, due to vapour exhaled from the skin, and thus we come again to the stagnated atmospheric envelope as the true clothing material.

I must now consider the relations of clothing to the cutaneous exhalations. We must always remember that these exhalations have the character of excretions—are poisons if returned inwards by absorption or otherwise. The enjoyment of full health demands that they shall be removed as speedily as possible. There are two kinds of personal dirtiness and two kinds of personal cleanliness; there is dirt that comes from without and dirt that comes from within. Those silly women who have imbibed the Parisian notion that soap and water spoil the complexion, and who, therefore, only dab and smear their skin with toilet vinegar or other cosmetics, have on a daily average dirtier faces than the blacksmith who at the end of his day's work indulges in a vigorous soaping, a copious swilling, and a cool, hearty dip in a big bucket of fresh water. The colourless excreted dirt that she plasters back is far more mischievous and more truly dirty than the carbon flocculi that modify the blacksmith's complexion.

The practical and philosophical question which this part of my subject suggests is: Whether clothing materials differ in their powers of absorbing the cutaneous exhalations; if so, which are the most effective, and what are the relations of this function to that of confining air, and thereby maintaining the temperature of the body? If these two

functions are opposed, then how shall we effect a compromise? If, on the other hand, they go together in any special material the desirability of using this material is doubly indicated.

These questions are answered by some very simple experiments made by Rumford and described in a paper read before the Royal Society on March 22, 1787, and republished among his collected essays in 1802. I will describe them in my next.

(To be continued.)

WATCH-MAKING AT THE INVENTIONS EXHIBITION.

(Continued from p. 481.)

IN the press-room are made and stored all the hands, wheels, balances, &c., that are made by stamping, or punching, but in the screw department, Fig. 3, automatic machinery is to be seen of the most ingenious, and, at the same time, most mathematically correct character. The exhibit includes one of these screw-cutting machines. Here will be seen a piece of steel wire 20 inches in length, automatically feeding into the machine. A small section of the wire is turned down, a die then approaches it and cuts a thread, and shapes a point on the reduced portion. A cutter divides this screw, together with a sufficient length of unreduced wire to form the head, from the main length. A carrier comes over, clutches the screw, takes it away, and places it in position for a revolving cutter to make the slot intended for the screwdriver, another tool then coming up and removing the burr from the screw-head. The screw being complete, a little rod is urged forward against it, driving it out of the carrier into a receptacle for the finished screws. This machine is capable of turning out 4,000 screws per day, the total output at the factory being 100,000 per day. All the attention that is required is to insert a length of wire in the machine as the previous length is used up. Even the lubrication is automatic (as it is with all the other machines), a fine stream of oil being directed on to the material as it is being worked from a reservoir, to which the oil again finds its way after leaving the machine. So little is the attention required that one boy is deputed to keep seven of these screw-making lathes going. Of the screws being made at the Exhibition it takes 250,000 to make up a pound in weight, the value of the wire being ten shillings. These screws, when finished, are valued at £350, or seven hundred times the cost of the material, which is, of course, of the best quality obtainable. In this department there is also an automatic pin-making machine, making 20,000 pins a day, for use in fastening hair springs. The general roughing down of pinions, centre staff, and other work of a kindred nature is also performed in the screw department.

The Jewel-making Department (Fig. 4) is unique and full of interest. The stones used are generally rubies, sapphires, and garnets, the latter being derived from Bohemia and Germany. Men are employed in superintending the jewel-setting operations. The jewels, when broken into fit fragments from the thin slabs or plates into which they are sawn, are given to girls, who set each on a mandrel, round it, centre it, drill it, and polish it, as is usual. They are then passed on to the assorters, who are also girls, and who, with a gauge of the simplest construction, but capable of indicating instantly, and for the most rapid inspection, the 1-100,000th of an inch, assort them according to their apertures. The jewel-setter then takes them, and placing one on a plate at the top of the rest of the lathe, which holds the tiny plate destined to receive the jewel, brings up a gauge against the jewel, pressing it lightly against a rib placed for that purpose, and by so doing sets the cutter, so that the hole which it cuts shall be exactly gauged by the jewel itself, and the jewel is fitted with absolute precision, and it is then in a moment burnished into its plate, which is then ready to be fastened into its place in the works by two of the tiny screws spoken of. The jewel gauge consists of a tapering needle, on which the jewel is threaded and which is then pushed back into a perforated holder until the jewel touches a collar placed for that purpose. At the inner end of the needle is an index, which shows on a scale the distance which the needle has been pushed into the collar, and thus shows the diameter of the needle at the point where the jewel stopped. Nothing can be simpler or more easily legible, and it will indicate to the naked eye even differences in the aperture of 1-2500th of an inch.

Fig. 3.

A month's turn-out in this department comprises upwards of 300,000 jewels, the work of 250 employés.

In the pinion department (Fig. 5) are also several interesting operations, some of which may be studied at the Exhibition. The wire is there seen in 18 in. lengths. One of these lengths is inserted in an automatic lathe for roughing the pinions into shape. The wire is urged through a hollow mandril, and as it revolves it is brought into contact with a stationary tool with a double-cutting edge, so shaped as to cut off the previously-turned pinion and at the same time to commence turning down the staff of another pinion, which latter labour is completed on the wire moving forward a little, by another tool. The first tool then cuts this pinion off and commences another as before. An arm passes over, seizes the partly-made pinion, carries it over, and places it in position for the pivot at the other end to be turned down by a tool somewhat similar to the others. It is then ejected into a receptacle, whence it is taken to another lathe and reduced automatically to exact dimensions. The ingenuity involved in this machine is simply marvellous. When it is stationary, the pinion is held but loosely, but when at work, it is perfectly rigid. After this, the pinion is placed in an automatic pinion leaf-cutting machine, where there are three little circular tools, each of which approaches the work in turn, and then commences to revolve rapidly.

Fig. 4.

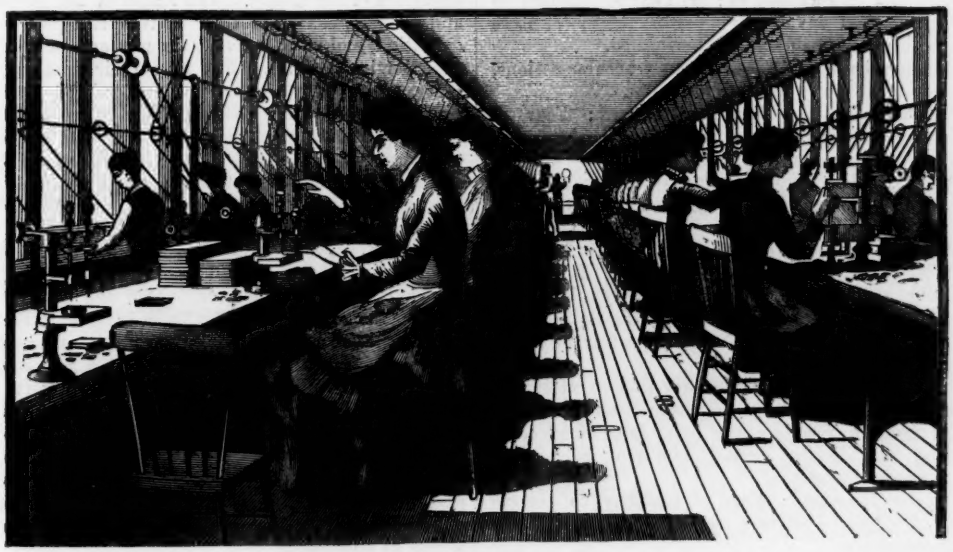


Fig. 5.

The first is a saw which makes a number of longitudinal cuts (in this case, eight); the next is a cutting tool which enlarges the grooves and brings the leaves approximately to shape; while the third, also a cutting tool, finishes them. All these operations are gone through in seventy seconds, and, when completed, the machine automatically stops working. The pivots have then to be finished, after which the pinion is hardened and polished, the polishing being done automatically and cleverly. In polishing the leaves, a polisher (of tin) is used which passes between the leaves, as they are presented to it by a little steel finger. Subsequently each pinion requires a little finishing by hand. Who can look at these different stages in the manufacture of a single small portion of a watch's mechanism and not be struck with wonder at the amount of thought, industry, and application bestowed upon a device for telling us how far we are from midday or midnight?

(To be continued.)

NERVOUS EXHAUSTION.

By Edwin Wooton.

(Continued from p. 436.)

THE subjective basis common to all the phenomena of complex nervous exhaustion is the occurrence of an idea concerned with a certain bodily act or mental condition of the individual, which act is carried out by the latter and into which mental condition he passes; and the proximate causation may be briefly summed up by saying that the controlling or volitional regions of the brain, owing to physical weakness, are unable to maintain their ascendancy over the body's mechanical nervous apparatus, which is itself in disorder and incapable of obedience; and that an idea of action communicated to the latter is carried out by it in spite of the individual's will.

These ideas may be classified as: (*a*) Fear of inability to perform; (*b*) Fear of involuntary performance; (*c*) Mere present cognition that such acts are performed.

All these ideas have reference, (1) to muscular actions, (2) to mental acts, (3) to glandular functions.

Chief Phenomena: (1) Muscular actions: Fear of inability—to speak loudly; to swallow; to perform any customary manual or similar bodily action, as walking straightly; to articulate clearly; micturate; keep the body steady or any particular part, as the head or hand; to perform many complex actions—as to look a certain individual in the face, to pass a certain spot, &c.; to keep the eye and facial muscles tense and firm. Fear of involuntarily shaking the limbs; breathing heavily; blushing, paling, or blanching; stammering and stuttering, speaking in falsetto voice. Mere cognition of a former fear, or of the act, or any of the above phenomena.

(2) Mental actions: Fear of inability to give utterance to eloquent or graceful language, maintain one's vivacity of manner and repartee, recollect any fact; fear of involuntarily calling up certain mental pictures, &c.; mere cognition of any of the above.

(3) Glandular functions: Fear of inability to secrete saliva; fear of excessive salivary secretion; mere cognition of either of the above.

These acts are all controllable by strong efforts of volition. As they occur, however, in exhausted nervous systems, the volitional efforts, except under great stimulation, are seldom capable of controlling any one such act.

With regard to the "complex actions" mentioned, there is no real dread of the person or place, but a particular mental state of perturbation having dominated the individual when in association with them through causes very frequently totally unconnected with the latter; whenever the patient and the objective person or place are again brought into relationship the mental condition once more supervenes; and it is this the sufferer dreads.

As examples, I may mention that commercial men find themselves dreading to transact banking or postal business. The sight of a person standing in a doorway in a street through which the nervous man is journeying will impel him to avoid passing such person, and he will turn back; or, if he exercise his strength of mind and continue his course, will be extremely uncomfortable until he has gone by the object of his unreasonable dread.

All the mental phenomena considered are due to exhaustion of the brain, the purely physical to that of the spinal cord.

With the incidence of chemical weakness the electric and magnetic states become disturbed, and their intensity decreases. The continuation of the exhausting causes results in the establishment of immature physically weak tissue, since, before the cells have had time to become developed, energy is demanded of them, and they become disintegrated, to be replaced by a still weaker material, the mischief being intensified with the lapse of time until the character of the brain-substance is little else than embryonic.

The chief factors in producing exhaustion both of the brain and spinal cord are (1) loss of blood or vital material derived therefrom, (2) insufficiency of food, (3) excess of tea, coffee, alcohol, and tobacco, (4) excessive muscular exertion.

Exhaustion of the brain separately may be produced by mental work, whether intellectual or mere worry. These must now be briefly considered. Nos. 1 and 2 need no special remark. With No. 3, however, I shall need to deal at length. One of the most important processes by which the functions of the body are carried on is that of oxidation of the tissues. The action of tea, coffee, alcohol, and tobacco, that is of their active principles, is to lessen oxidation, and so to prevent tissue waste or destruction in this particular form. But here their identity of action ceases; for while tobacco produces only the result given, putting on one side absolute blood-poisoning from very excessive smoking, chewing, or snuff-taking, which cases are rare, tea, coffee, and alcohol stimulate the brain and spinal cord, compelling them to an increase of work and producing destruction of material, and its excretion in manner other than by oxidation.

If, then, prevention of the last-named process were in itself beneficial, there would yet be a set-off in the other modes of waste alluded to. But the benefit resulting from lessened oxidation is limited; it is, in fact, a mere rest of the tissues, and this, if pushed to an extreme, has, as an inevitable sequence, tissue degeneration, since old and otherwise effete material is made to retain its place and fulfil its duties as best it may, instead of having its labours completed by such oxidation, which would result in its removal and its replacement by a fresh formation.

It may be said, therefore, that while alcohol, tea, coffee, and tobacco act as sedatives by arresting a certain form of natural waste, the three first have, in another manner, an action as stimulants.

The laws of every human body are identical—that is, physiology knows no individual variation—but the intensity of such laws, or the susceptibility of the person to certain influences, are in no two cases exactly equal. For this reason, it is impossible to lay down a rule which shall be universally applicable as to the exact amount of tobacco,

tea, coffee, or alcohol which may with benefit, or even with immunity from evil, be consumed. As I have said elsewhere, "Every man is a law to himself in these matters," his own sensations indicating whether he is deriving benefit or injury from any practice he may pursue.

In connection with the subject, the question of the pleasure resulting to an individual from any particular habit must be taken into consideration. For the beneficial effects produced by the four articles with which I am dealing, will as readily result from certain medicines, which, moreover, may be so prepared that no deleterious action whatever shall follow.

It may be stated, broadly, that while a very few persons, with a distaste for smoking, pursue the practice merely to fall in with custom, none smoke to excess who do not love the weed. Since the former class smoke but little, the ill-effects, if any, are temporary and consist of nausea or headache. This very moderate smoking does not produce lasting nervous symptoms, and it need not be further considered.

When a taste for tobacco exists, and the person smokes to excess, there is no substitute for his favourite herb which can be offered him. Stramonium is an abomination to the smoker, and all the various vegetable preparations which have been tried have been found wanting in that peculiar fragrance and flavour which render tobacco dear to its patrons. Alcohol, on the other hand, is desired by its habitual consumer, not so much for the flavour of the drink as for its stimulating properties. I have said that, besides arresting oxidation, alcohol stimulates the nervous system. But as alcoholic liquors contain few nutritious principles to offer to the tissues, the result of such stimulation is a greater destruction of material and excretion of its elements than can be supplied by the drink in question. Consumers of alcohol uncombined with nutrient principles live on their vital capital, and the result of this, added to the continued impediment to oxidation, is such a weakness of the nervous centres that the individual feels in a state of nervous atony, and flies to the only thing which he knows will give him relief—the stimulant which has caused his wretchedness.

Now, this craving for a "Pick-me-up" can be satisfied by properly-prepared nerve foods, and the result will be not merely the relief of the person's sensations, but the strengthening or nutrition of the nervous system.

Tea and coffee, like alcohol, are but scantily nutritious, and supply but little material for energy. Of the millions who habitually drink these two non-intoxicants, some there are who do so because of their stimulating effects, but the majority, there is little doubt, merely from custom. But this altogether fashionable use of the drinks, since it involves the consumption of nearly as great a quantity of the fluids as if the drinkers possessed a taste for the latter, results in a proportionate amount of mischief. In both cases it very frequently happens that, as the permanent effects of the drinks begin to be felt, the consumers resort to alcohol in order to overcome the debility they feel, with the inevitable result of its intensification. Tea, coffee, and alcoholic liquors are valuable as medicinal agents to be given when circumstances point to their use as proper; but as ordinary beverages they should be very sparingly taken. Never should they be drunk habitually as "Pick-me-ups," that is to remove a feeling of nervous weakness. The very fact of such sensations being experienced should convince the sufferer that he needs *nerve food*, that his nervous system requires strengthening, and that he cannot afford to draw on its energy without taking such "food."

EXCESSIVE MUSCULAR EXERTION.—It is to the uninitiated astonishing to find how many athletes are nervously affected. A great amount of muscular exertion, unless accompanied by such a dietary as may supply materials for the tissue destroyed, will result in weakening the spinal cord and certain parts in the brain concerned in controlling the muscles, and called "motor areas," until they are unequal to the steady discharge of their functions, and may, through physiological laws with which I have not space to deal, exhaust the whole nervous apparatus.

MENTAL WORK.—Remember that all mental action results in destruction of nerve-tissue. The emotions of hate and grief, as well as fretful worry, are as brain-wearing as hard study. In violent-tempered persons, the temporary debility produced by each fit of passion is very manifest. The excessive work demanded of the nervous system need not necessarily be an enforced energy during a certain minimum period of time; on the contrary, deprivation of sleep is as exhausting to the brain, and of bodily rest—to the spinal cord, even though the individual be occupied in pure amusement, or be inactive and listless, as if the brain and cord were engaged in the work against time alluded to. For so long as the individual is awake, so long is there an expenditure of nervous energy, and consequently of material, over that which occurs in sleep; the quantity of such excess being in proportion to the activity of the body or mind of the person concerned. To repeat what has been before stated: A balance of waste and repair may be said to be struck diurnally. During the waking state there is more loss than repair; during sleep there is more repair than loss. The mechanism of sleep may be considered at some future date; here it is sufficient to say that sleepiness is the conscious expression of the brain's weariness and temporary exhaustion; of its desire also for repose and opportunity for recuperation. So, weariness of the body, the "feeling tired," is an indication that the spinal cord and the muscles likewise need rest and opportunity for repair. But rest and sleep are valuable, not merely on account of the tissue-formation they allow to proceed, but also that they afford opportunity for existing nervous tissue to mature—to come to the adult state of development.

The condition of nervous exhaustion may be congenital and inherited—that is, there may be both an irritability and physical instability of the nervous tissue, which, if not physiologically treated, will develope with the growth of activity in the body and mind into simple exhaustion.

When the producing causes of this last are brought to bear on a system already predisposed to, or incipiently the victim of the condition, there results a state of nervous weakness far exceeding in degree that of the merely acquired variety. The distinguishing characteristics of complex nervous exhaustion are due to the occurrence of the simple variety in persons possessing the faculties of imagination or apprehension strongly developed.

It must be understood that while the brain tissue requires for the performance of its duties a certain chemical composition, the normal condition of this latter may be found in very unintelligent persons, in idiots even, since it simply enables the brain to perform its duties as constructed. Brain-power, that is intensity in the strength of the higher mental faculties, is due to elaboration of structure, and the steadiness with which such power is manifested is dependent on the maturation of the nervous tissue. Hence complex nervous exhaustion is very frequently found to affect the very highest intellects. When the condition occurs in persons of such brain development, the psychological phenomena peculiar to them are unmistakable. There is a rough majesty of mind imperial in its broad sway of power. The being will invent, discover in science, create poetry, fiction, or works

of art; but in each and every such effort, while as a whole it may be noble, there are errors of detail needing his subsequent correction, and showing the irritability of the conceiving power, whose rapid, spasmodic action could not be controlled to the consideration of momentarily occurring trifles, but passed them by to encounter mightier obstacles.

An analogy might be drawn between the phenomena of complex nervous exhaustion affecting a very high intellect and the symptoms seen in the athlete suffering from the simple form of the complaint. As the mind of the one aims at gigantic efforts, and can hardly control itself to the consideration of minute details, so the muscles of the other can perform heavy labour, but cannot be maintained under steady command when required to execute some slight muscular effort necessitating absolute steadiness. In both cases there is irritable and spasmodic action.

(To be continued.)

THE BOULDER-CLAY OF CHESHIRE.

AT the meeting of the Geological Society on May 27, a paper was read "On some Erratics in the Boulder-clay of Cheshire, &c., and the Conditions of Climate they Denote," by Charles Ricketts, M.D., F.G.S.

The author stated that the glacial phenomena of the valley of the Mersey indicate that the country has been entirely covered with ice and snow, resulting solely from the snowfall on its water-slopes and those of the tributary valleys. The glacial striæ coincide in direction with that of the respective valleys, or are in direct connection with the contour of the ground. The bottoms of the valleys are usually filled to some extent with irregularly stratified sands and gravels, containing erratic pebbles from which all striæ have been removed, probably by currents, of water holding sand in suspension. Above these there is a boulder clay containing a larger proportion of sand and gravel than the boulder-clay proper. The flanks of the valley are covered with unstratified sand or fragments of sandstone derived from the Trias, probably left by glaciers as submarine moraines. The whole is overlain by the true boulder-clay, an unstratified reddish-brown clay containing erratics derived from different and distant localities. This clay originated in the grinding action of the glaciers upon the neighbouring rocks, and was carried out in the form of mud by subglacial streams of water. The contained pebbles, many of which are smoothed, flattened, scratched, and striated, were carried by and dropped from icebergs and floating ice; they are so abundant as to indicate that the bay of Liverpool was densely packed with ice.

The author noticed the occurrence in these beds of masses of contemporaneous sands, gravels, &c., caused by changes in the extension of the glaciers, and described a large series of erratics derived from granitic, volcanic, silurian, carboniferous, and other rocks covered with striæ and other glacial markings, and also affording evidence of subsequent exposure to weathering before they were floated away and dropped into the clay. In connection with this weathering of the boulders, the author remarked that in the case of the granitic and volcanic rocks the process differed greatly in degree, extending in some granites to the separation of each individual grain throughout the whole mass, and he called attention to the occurrence in Ireland of fragments of disintegrated granite and trap imbedded in moraines, eskers, and Boulder-clay, and to that of Westdale-Crag granite similarly decomposed in the moraines in the neighbourhood of Shap, where also rocks of volcanic origin have become weathered in the same way as some in the Boulder-clay of Cheshire. Fragments of limestone also show traces of erosion, while others have been split into two or more pieces since their glaciation, phenomena also observed in moraine-accumulations in limestone districts. Similar phenomena occur in the case of slaty and other stratified rocks. Some limestone pebbles have been perforated by Mollusca and other marine animals.

The inference drawn by the author from the facts recorded in his paper is that these weathered boulders once formed portions of moraines on land from which, for a time, the glaciers had receded, and that, after a succession of seasons sufficient to disintegrate these blocks more or less, an increased snowfall caused such an extension of the glaciers that the blocks were carried down to the sea and conveyed away in icebergs and by floating ice to the spots where they are now imbedded. As they occur at different horizons there must have been a repetition of the advance and retreat of the glaciers such as now occurs in Greenland.

FIRST STAR LESSONS.

By RICHARD A. PROCTOR.

THE constellations included in the twenty-four maps of this series are numbered throughout as follows (the names being omitted on the maps, to clear these as far as possible from all that might render the star-grouping less distinct):—

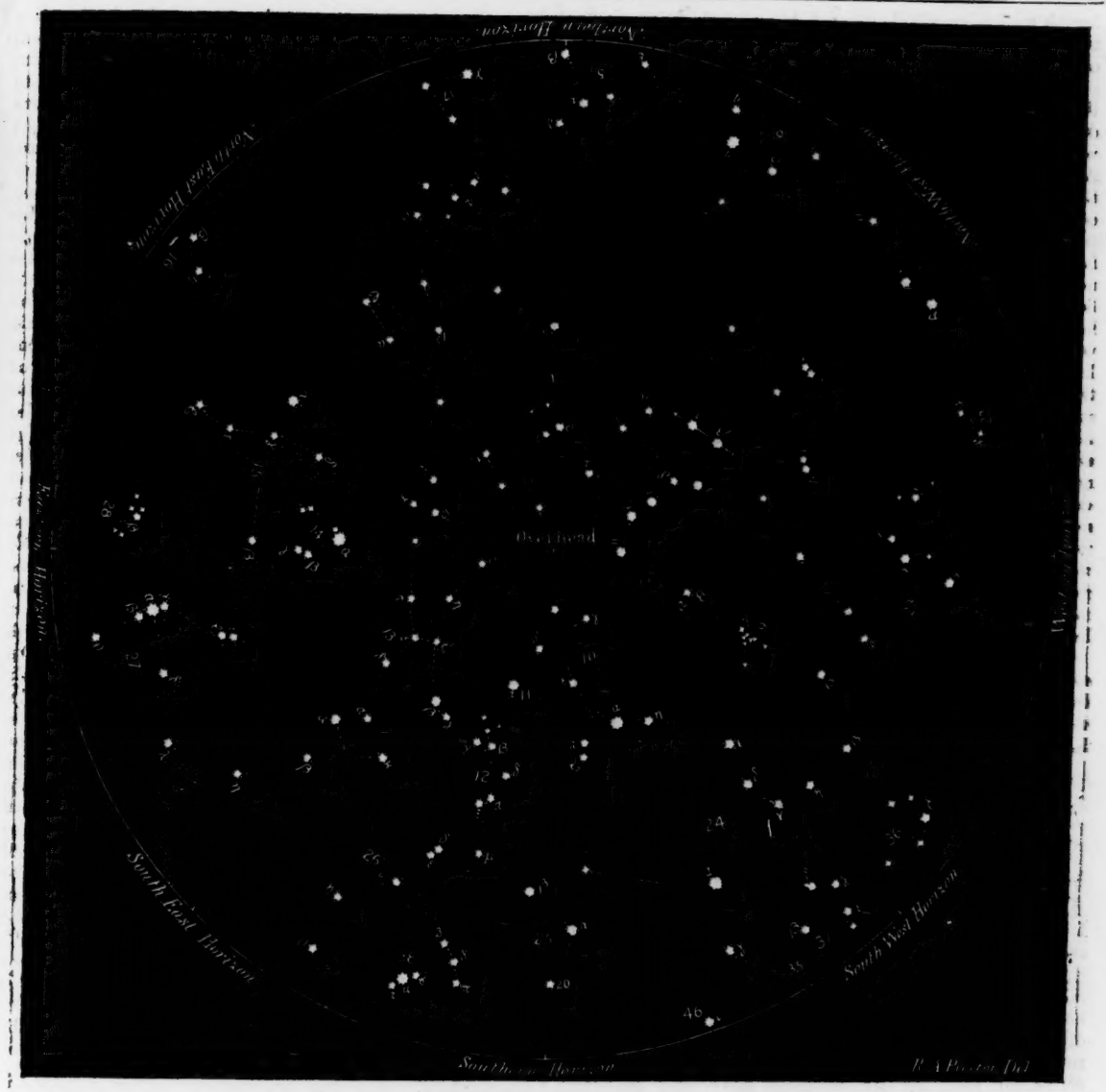
1. *Ursa Minor*, the *Little Bear* (*a*, the *Pole Star*).
2. *Draco*, the *Dragon* (*a*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*a*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*a*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*a*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*a*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*a*, *Vega*).
15. *Cygnus*, the *Swan* (*a*, *Arided*; *β*, *Albires*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*a*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*a*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*a*, *Regulus*).
24. *Virgo*, the *Virgin* (*a*, *Spica*)
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*a*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.
33. *Orion*, the *Giant Hunter* (*a*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*a*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*a*, *Alphard*).
36. *Crater*, the *Cup* (*a*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*a*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*a*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*a*, *Sirius*).
45. *Argo*, the *Ship*.

SHOOTING STARS.

THE passage in our last from the *Annuaire* for 1836 led to the following amusing communication from an American correspondent of the *Penny Magazine*:—

Having read in various publications, accounts of the appearance of what are there termed shooting stars, which happened in North America on the morning of Nov. 13, 1833, and as such accounts are in many respects erroneous as to facts and, in my humble opinion, as to the causes; I, having been myself an eye-witness of the phenomenon in question, think it but right, in aid of science, to give a statement of such circumstances as came within my observation, the truth and correctness of which may be relied upon, leaving it to more enlightened minds to find out the operating cause of such occurrences.

Having awoke about an hour before daybreak on the morning of Nov. 13, 1833, it being then dark, with the exception of the stars (the moon then about two days old), I was surprised to find a constant flashing of light in my room, as if from the flickering of a dying lamp, or from faint flashes of lightning, and, as the window-blinds were down, I arose and went to one of the windows to ascertain the cause; when, lifting up the blind, I was astonished to find it literally raining fire, coming down like a smart shower of snow, or rather hail. I immediately roused the whole of my family to witness the phenomenon, and then, throwing on a few clothes, hurried out of doors to observe this great event more minutely. Upon going out and



NIGHT SKY FOR JUNE (FIRST MAP OF PAIR),

Showing the heavens as they appear at the following hours:—

June 3 at 10½ o'clock.	June 11 at 9½ o'clock.	June 18 at 9½ o'clock.
June 7 at 10 o'clock.	June 14 at 9½ o'clock.	June 22 at 9 o'clock.

finding this apparent fire to be perfectly harmless, I began to examine its peculiarities. I found that *this shower of fire consisted of globules varying in size generally from a pea to a hazel-nut, with here and there a few as large as pigeons' and hens' eggs, and one in particular which fell about twenty feet from me was nearly the size of my fist.* They all came down in a regular uniform slanting direction from south to north at an angle of about 30° from the perpendicular, not crossing each other, but *falling gently until within about five or six feet of the earth,* then bursting and throwing out in a horizontal direction towards the north a stream of light, comprising all the prismatic colours, the brightest and most beautiful that can be conceived, and then vanishing gradually. The largest before mentioned I noticed in particular, which in its relative position from me had a dark forest *in the background,* whence I could observe it to greater advantage, and *from its size* was slower in descending, bursting, and vanishing. This one threw out a bright belt or stream of many colours, apparently a foot broad, perfectly horizontal, *about eight feet from the earth, reaching entirely across a meadow until it touched the woods, the space being there by measurement* 175 *yards;* it then vanished very gradully, occupying from four to five seconds from first to last. I continued watching the phenomenon until the day breaking rendered them indistinct, and at

length no longer visible; but I have no doubt they continued falling for a considerable time after, *and until the atmosphere became rarefied by the sun's rays.*

It will here, perhaps, be proper to give some account of the state of the weather, and of the atmosphere immediately preceding and during the above event. The period when this phenomenon occurred was what is called in America "the Indian summer," which generally begins in the early part of November, and continues for one or two, or even three weeks, during which time the weather is perfectly calm and warm both by day and by night, with a hazy, smoky appearance in the daytime; and in the afternoon of the 12th there fell a light, gentle rain, which lodged like dew on the grass, and continued for about half an hour, after which it cleared up, and presented a calm, clear, warm, starlight night. On the morning of the observation I laid my hand on the bare ground, which felt comparatively warm, and on looking at my thermometer found it standing at 66° Fahr.; but as I had no barometer I cannot state what the pressure of the atmosphere was. The above observations were made on a farm about six miles north-west of Baltimore, and upon conversing with others on the subject I learnt that the phenomenon extended southward all over the State of Virginia, where it was still more brilliant, and north-eastward to Philadelphia, where it was fainter, but was not visible at New York; for going to the latter city a few days after I made many inquiries, but could find no one who had either seen or heard anything of it.

In one of the accounts I read some attempt is made to count the number of stars, as they are called, that fell; but from what I saw it would be as easy to count the number of flakes of snow or hail-stones during a moderate fall.

NOBERT'S RULING MACHINE.*

By JOHN MAYALL, JUN., F.R.M.S., F.Z.S.

(*Continued from p. 453.*)

HAVING given you a general view of the meaning and purpose of the fine rulings produced by Herr Nobert, I proceed to the description of the ruling-machine itself, and of the methods he probably employed.

The foundation of the machine is a dividing engine, calculated to produce parallel divisions far finer than could be marked by any ruling point yet discovered. The division-plate is about 12 in. in diameter, and has twenty rows of "dots," by means of which two bands of silver embedded near the circumference have been graduated with extremely fine lines to every five minutes in arc. These gradations are viewed by two compound microscopes, each provided with eye-piece screw-micrometers of special construction. The microscopes can be fixed at various points on the edge of the main iron bed of the machine, so as to check the rotation of the graduations of the division-plate; and the eye-piece screw-micrometers in the microscope enable the observer to subdivide the graduations by inspection, and to correct the movement of rotation, within very narrow limits. The rotation of the division-plate is effected by a tangent-screw acting upon a worm on the edge of the division-plate. The tangent-screw is controlled by a large milled head, and a graduated drum shows the amount of motion. A screw adjustment is provided, by which the tangent-screw can be disconnected from the division-plate. In order to equalise the pressure of the tangent-screw against the division-plate, it is mounted to swing between conical bearings, and a counterpoise on a lever arm beneath keeps it in contact with the worm. The method employed by Nobert for obtaining the minute divisions of his test-plates was, to utilise the radius of the division-plate as a lever to move the glass plate on which the rulings were made at right angles to the motion of the ruling point. For this purpose, he attached to the centre of the division-plate a bent arm, on which slides a bar faced with silver, having at one end a finely-polished steel point which can be adjusted by a scale and vernier so as to project more or less beyond the centre of the division-plate or axis of rotation. The radius of the division-plate thus becomes the long arm of the lever, whilst the radius of the projection of the polished steel point beyond the axis of rotation forms the short arm, the centre of the division-plate being the fulcrum. The motion of the short arm of the lever is communicated by contact with an agate plate to a polished steel cylinder, adjusted to slide at right angles to the movement of the ruling point in V-shaped bearings of agate. The steel cylinder carries a circular metal table, on which the glass plate to be ruled is fixed by wax and clamps. To diminish the friction of the steel cylinder on the agate bearings, a counterpoise is provided, to lift it on a roller, whilst a weight, attached by a silk cord to one end, keeps the agate plate in perfect contact with the motor steel point. The motion of the lever arms is, of course, in arc, and hence the division would not be strictly equidistant unless compensation were made for the difference in length of the arc and its sine; but since the actual space included between the first and last lines of the test-plates hardly exceeds 1-50th inch, this difference would be inappreciable. It may be assumed that Herr Nobert used the arc motion during the process of division only, and that for moving the plate over the spaces of the blank bands between the rulings he utilised the fine screw connected with the agate plate in the steel cylinder, by which a motion of the plate of about $\frac{1}{1000}$ of an inch can easily be effected; in this way he would reduce the total motion of the division-plate in arc to about one-half. It would be possible to increase or decrease the successive divisions of the bands by increasing or decreasing the length of the short arm of the lever; but, in view of the risk which such adjustments would involve, it is highly improbable that such a plan was adopted. There are other possible methods of effecting the divisions, all involving risks of large errors; the most probable conjecture is that Herr Nobert used the greatest possible excentricity of the short arm of the lever, so as to utilise the smallest motion in arc required for his subdivisions.

The arrangement for carrying and adjusting the diamond point is specially ingenious. The questions to be solved were—(1) to provide means to adjust a diamond edge to any angle within required limits; (2) to balance it truly, so that the weight-pressure for ruling could be perfectly controlled; (3) to raise and lower it strictly in one plane—that is to say, mechanically free from lateral play, so that the consecutive divisions of the ruling depended solely on the motion imparted to the glass plate by the dividing engine; (4) to cause the diamond to oscillate freely in one plane; (5) to control the length of the lines to be ruled; (6) to connect the whole with mechanism to insure an even rate of speed in the ruling movement of the diamond.

These matters have been worked out by Herr Nobert with extraordinary perseverance, as is evidenced by the elaboration of the adjustments. I should despair of making myself understood on these points by mere verbal description; I shall, therefore, ask you to inspect the mechanism at the close of my remarks, for, to be under

* From the *Journal of the Society of Arts*. A paper read before the Society on May 6.

stood, such complex adjustments need to be seen "in the flesh."

It would be an easy matter to suggest simplifications and possible improvements in this part of the machine, but it must be noted that Herr Nobert had always to work with very limited means, and under the great disadvantage that he thought it necessary not to disclose his methods of working. Judging the mechanism by the work he did with it, there can be but one feeling among all who are familiar with his ruled test-plates—a feeling of intense admiration for the inventiveness and extraordinary dexterity he brought to bear on the subject under the circumstances.

(To be continued.)

Editorial Gossip.

ENGLISH astronomical observers, like the old Scottish woman in the story, have, indeed, to be "thankfu' for sma' maircies" in the shape of clear skies, if we may judge from a little paper by the Rev. S. J. Johnson in the current number of the R.A.S. *Monthly Notices*. In the paper to which I refer Mr. Johnson tabulates the number of fine nights in every year during the last quarter of a century. That he is not very *exigéant* may be gathered from his own definition, for he says, "By evenings fit for observation it is inferred that the sky was clear, or with a few small passing clouds, till about 11h., or else thoroughly clear for a full hour. Clearness of the atmosphere alone is regarded . . . . not suitability for dividing very close double stars." The table which follows the words I have quoted would, I venture to think, a little astonish those who have no specific object in watching the night sky. The greatest number of nights complying with Mr. Johnson's very moderate requirements is set against the date 1874, when 113 appear. On the other hand, in 1860, there were only forty-four nights out of the 366! which answered to his definition. Taking the average of the twenty-six years which he tabulates, it would appear that we are entitled to look for eighty moderately decent nights per annum. How many, or, rather, how very, very few, of these are really fine enough for delicate double-star work or the scrutiny of planetary detail, let the practical observer bear testimony.

QUOTING the *Monthly Notices* suggests to me to remark that the last two numbers have been issued in very good time indeed, so that country Fellows have been enabled to read, mark, learn, and inwardly digest the papers read at one meeting before the next one was held. There is an old proverb which cautions one against "looking a gift-horse in the mouth," so that I will not inquire too curiously into the causes which have operated in producing so very desirable a result. It is certainly a gratifying change from the thirty-nine days' waiting on which I commented on page 90.

FROM the number of *Ciel et Terre* for June 1 (a number, by the way, overcrowded out of all proportion with meteorology pure and simple) I learn that M. Folie is appointed successor to M. Houzeau as Director of the Royal Observatory at Brussels.

CERTAIN wiseacres in the United States having observed Venus near the horizon before sunrise during the early part of the present year, have been rushing into print to proclaim the return of the Star of Bethlehem, or Star in the East of Matthew ii.! This pitiable exhibition of superstition has been made the foundation of an interesting paper by Professor Payne, the director of the Carlton College Observatory, Northfield, U.S., in the *Sidereal Messenger*, which he so ably edits. In it he discusses the various hypotheses which have been propounded to account for the apparition recorded in the first Gospel, including the conjunction of Jupiter, Saturn, and Mars, A.C. 3; concerning which Ideler, Encke, and others have written with so much misplaced learning. How far two planets 1° apart could ever appear like one star, the reader may judge for himself by looking to-night at Jupiter and Regulus, and seeing how far it is possible to persuade himself that they form a single object. Moreover, the more plausible theory that it was a temporary or variable star akin to Tycho Brahe's in Cassiopeia, the one which appeared in Corona Borealis in May, 1866, or Schmidt's Nova in Cygnus of 1876, seems practically disposed of by verse 9 of the second chapter of Matthew. Upon whatever other points they may differ, there seems a consensus of opinion among the pyramidalists, Star of Bethlehem, and conjunctions-of-the-major-planets men, and the rest of the crazy fraternity, that such a sight in the sky means the imminent end of our terrestrial habitation. When occasionally people talk such nonsense to me, I always repeat what I once heard Sir George Airy say, that "the world will last our time."

CASUALLY taking up a number of a contemporary journal a day or two ago, I was struck with a violent onslaught on Gresham College which appeared in it. Reading the article through, however, and noting that, while Dean Burgon, Dean Cowie, Dr. Abdy, and Dr. Wylde were severally buttered-up, the name of Mr. Ledger, the professor of astronomy, was conspicuous by its absence, I fell to wondering whether the author of the tirade could, by any possibility, ever have opposed Mr. Ledger for that professorship—and been defeated.

WHILE waiting for a train at Clapham Junction last week, and watching the people enter those departing for Epsom Downs, I could not help speculating whether, among his composite photographs, Mr. Francis Galton had ever combined a series of the lower order of sporting men to form a typical portrait. If he has, or should he in future do so, he cannot fail to obtain as hard, cunning, and evil a type of countenance as it would be possible to depict.

ONCE more I must make an appeal to my multitude of correspondents, and request them to note:—1. That I neither can nor will correspond privately with them upon any subject whatever; and that stamped envelopes enclosed for replies to questions about the solution of equations, the time of sunrise, the amount of the National Debt, and so on, go into the waste-paper basket straightway. 2. That in the case of contributions proffered either in the shape of letters or articles, I will not return them unless they are accompanied by envelopes legibly addressed and sufficiently stamped. 3. Taking care, as I do, to assure myself that every review that appears in these columns is written without fear or favour, and is the expression of the matured opinion of the writer who pens it, I entirely refuse to enter into any argument with the authors of books who consider that they have a kind of divine right to measureless and unstinted praise, and that any one daring to differ from their expressed views must be a heathen man and a publican. And 4. I do not sell a single one of the articles described or advertised in these columns. Last week I was favoured with an order (and postal notes) for a knife-cleaner and something else! I regret to be compelled to occupy so much space by mere reiteration; but I have so often said substantially, though with apparently little or no effect, what I have just repeated, that I am compelled to say it all over again here.

Reviews.

PRE-HISTORIC AMERICA.*

THIS is a companion volume to its learned author's "Les Premiers Hommes et les Temps Pre-historiques," which dealt with the Stone Age in Europe. There is no lack of treatises in both English and Continental languages on this latter subject, and the expositor has the easy task of treading in well-worn footsteps. The uniform character of the relics of Palæolithic man, unearthed in thousands from river-gravels and bone caverns, has left little play for archæological vagaries or for speculative fancies concerning their makers. But it is otherwise with the pre-historic races and those often stupendous relics of the New World which have long been looked at through the magnifying and tinted glasses of the romancer and the sciolist, and have been invested with the glamour and mystery in which ignorance covers its nakedness.

Among the crude and imperfectly-digested hypotheses which have engaged the attention of untrained ethnologists, none have been more popular than those which ascribed the origin of the Americans to full-fledged races such as we know at present in other regions of the world. Among those who have been claimed as the original or genuine ancestors of the Americans are the Chinese, the Japanese, the Malays, the Egyptians, the Phœnicians, the Basques, the ten lost tribes of Israel, the early Irish, the Welsh, the Norsemen, some unknown Asiatic Freemasons, and other equally unknown Buddhists. Volumes have been filled with the most enthusiastic rubbish by men upon whose ability and sanity in other matters nothing has ever thrown a doubt. Fortunately the era of such speculations is passing away. The scientific treatment of anthropological subjects is no longer the exception.

The "ten lost tribes" still linger with us, and doubtless will continue to do so for some time, probably becoming in their turn the subject of investigation by psychologists interested in aberrant mental phenomena. But every day increases our knowledge of the true constitution of savage society, and builds a more enduring barrier against the floods of pure hypothesis.

The foregoing extract is a guarantee that we have in the present work a sober contribution to a subject over which so many writers have lost their heads, but which, under the treatment it now receives, falls into its relative place in the general science of human culture. M. De Nadaillac's volume covers more ground than the title indicates, the larger part of it, and that necessarily the most copiously illustrated, having more interest for the antiquarian than for the anthropologist; but in the earlier and later chapters, as well as in the references to cosmogonic legends and religious beliefs and practices scattered throughout the work, the anthropologist will find enough and to spare of interesting and suggestive matter.

In all that the author and his American editor (from whose revision the book has largely gained) have to say concerning the co-existence of man with mammals now extinct, concerning the character of his earliest known relics and the deposits in which they occur, concerning his place in the geological record, the reader will be struck with the parallelisms between pre-historic peoples of the Old World and the New, with the proofs of the strictly analogous phases of culture through which man has everywhere passed in his ascent from savagery, and with the absence of any essential physical difference between races, their unity, as the author remarks, "standing out as the great law dominating the history of mankind." Of course, they did everything on the biggest scale in America from the earliest times. The kitchen middens or refuse and offal heaps which are scattered along the shores of the Baltic, although of considerable size, are very "small pumpkins" to the like shell-heaps and sambaquis along the Atlantic and Pacific coasts, some of which cover many acres and reach a height of forty or fifty feet; the more remarkable mounds, to be referred to presently, are, compared to the tumuli of the Old World, as the Himalayas to the Mendip Hills; the pyramids challenge comparison with the famous pyramid of Cheops; the palaces vie with the classic ruins of the Palatine; and the megalithic remains would enclose a mightier ruin than the broken circle of our Stonehenge. In the summary of evidence concerning man's antiquity in America, the cautious spirit in which the author approaches the problem is apparent. He has not listened to the charming of the French savans who find human relics in the middle Tertiaries in Europe. Although agreeing that man lived before the glacial epoch in North America, he recognises the difficulty of fixing the precise time of his appearance, and in the uncertainty which attaches to the exact deposits in which certain relics of him—notably the Calaveras skull—occur, wisely leaves the question open. But the main interest of the volume gathers round the exhaustive account which the author gives of the thousands of artificial mounds in the great river-valleys south of the Rocky Mountains, and along the Gulf of Mexico through the length of the Southern continent. They appear to have little or no relation to the burial mounds scattered over Europe and Asia, and which are referred to pre-Aryan tomb-raising peoples, being unlike in their fantastic shapes, and apparently intended for defensive and sacrificial, as well as for sepulchral, purposes. Many of them are of geometrical form, oval, square, round, more rarely, polygonal or triangular, either rising from hill summits, or standing solitary on plains, or enclosed within earth-walls. In some parts of the far West the mounds represent mammals, birds, and reptiles; indeed, some bold architects have not hesitated to attempt to imitate the human body. In Wisconsin "they represent men with the trunk, head, arms, and legs still recognisable; mammals sixty-five yards long; birds with outspread wings measuring more than thirty-two yards from the tip to tip, reptiles of colossal dimensions, and, lastly, Pigeon mentions having seen in Minnesota a huge spider, whose body and legs covered an acre of ground." The cyclopean character and varied forms of these mounds led superficial inquirers to attribute them to some mysterious race of "giants in those days" which has completely disappeared, and with which the extant Indians of the Americas have no affinity. That the works are of vast and undetermined antiquity is unquestioned; for, as with the rough measurement of the deposition of remains beneath the successive layers of trees in the Danish peat-bogs, the lapse of a long period is evidenced by the generations of varieties of trees which cover the mounds. And if, as M. de Nadaillac points out, we look among existing tribes for the lineal descendants of the Mound Builders, we may look in vain, since the richest, the most cultured, and most sedentary of the Indians existing when the white race poured into America like a resistless flood, have been destroyed; of many tribes none remain, of others only a feeble remnant which has readily adopted the methods and arts of the dominant race. Nevertheless, the conclusion at which the author, in agreement with the leading authorities, arrives, is that expressed by Dr. Brinton as follows:—"All these earth-works—and I am inclined to assert the same of the whole of those in the Atlantic States and the majority of the Mississippi Valley—were the production, not of some mythical tribe of high civilisation in remote antiquity, but of the identical nations found by the whites residing in those regions." To which may be added the opinion of Schoolcraft. "There is nothing indeed in the magnitude and structure of our western mounds which a

* "Pre-historic America." By the Marquis de Nadaillac. Translated by N. D'Anvers. (London: John Murray. 1885.)

semi-hunter and semi-agricultural population, like that which may be ascribed to the ancestors or Indian predecessors of the existing race, could not have executed."

The state of relatively high culture which these races, while still in the Bronze Age, had reached, is described in a profusely-illustrated chapter on their tools and weapons, and to this succeeds a striking account of the ruined beehive-like pueblos or communal villages built in valleys once fertile, but now barren and deserted, or on cliffs accessible only by ladders or by steps cut in their sheer sides.

Such sites were obviously chosen, like those of the lake-dwellers in Central Europe in the past, and in New Guinea and Central Africa to-day, for security against fierce and dangerous enemies. But an enemy more irresistible than these—diminished rainfall through destruction of forests, and consequent barrenness—effected the decay of these energetic dwellers in the rocks.

The ruins of Central America and Peru; temples—scenes of revolting rites—and palaces obscured in the densest vegetation, statues, idols, bas-reliefs, rock-paintings and sculptures, the grotesqueness of the art unredeemed by any feeling of the beautiful, Nature alone festooning them with her wild loveliness; the rise of the famous dynasties, Aztecs and Incas; are the subject of copiously-illustrated chapters, which narrate in easy, flowing style the story of these ancient civilisations. In the final chapter, which is mainly the work of the American editor, the origin of man in the New World is discussed, and the conclusion deduced from the general laws of geographical distribution and from the physical characteristics of the several races, is that he is not anthochthonous.

A copious index completes the usefulness of a book which is indispensable to the anthropologist.

EDWARD CLODD.

SOME BOOKS ON OUR TABLE.

A Manual of Health Science. By ANDREW WILSON, F.R.S.E., F.L.S., &c. (London: Longmans, Green, & Co. 1885.)—Every one interested in hygiene—and who is not?—who is desirous of obtaining the soundest opinion on the results of the most recent investigations in, and an eminently practical manual of all pertaining to it, will not fail to procure a work, the mere name of the author of which affords an *à priori* guarantee of its excellence and trustworthiness. Dr. Wilson treats in succession of the general conditions of health and functions of the body, food, diet and cooking, water, air, and ventilation, the removal of waste, local conditions of health, shelter and warming, and the care of the body. Then follows a most useful and admirable chapter on "Ambulance work, or first aid" to the injured; while the concluding one deals with "Infectious diseases and disinfection." A series of questions to test the apprehension of the reader, and a good index, complete a volume the perusal of which may be confidently recommended to all who value their health and wish to keep out of the doctor's hands.

La Science Pratique: Journal des Procédés et Recettes. (Paris: C. Delagrave. London: Barthes & Lowell.)—This journal is made up of a collection of receipts extracted from periodicals in every European language, and will be found exceedingly handy by many who often regret that they did not copy out some recipe at the time when they first saw it. We, of course, pre-suppose the power of reading French with tolerable ease, as it is in that language that "La Science Pratique" is published.

Child-culture, Mental, Moral, and Physical. By T. M. MADDEN, M.D., F.R.C.S.E., &c. (Dublin: Fannin & Co. 1885.)—Dr. Madden treats, in a lucid and popular style, of Infant Mortality, the Management of Infancy, Milk Foods, the Hygiene of Early Childhood, the Nursery, Exercise, Sleep, Childhood, the Moral Culture of Children, and their Mental Training or Education. His thoughtful and useful little tract should be studied by every young mother.

Land. By the PARLIAMENTARY COMMITTEE OF THE LIBERTY AND PROPERTY DEFENCE LEAGUE. (London: Offices of the League. 1885.)—Witty, shrewd, argumentative, and incisive, this little book will afford as much genuine amusement—and even fun—as it will instruction, which is giving it high praise indeed. A gentleman named Fyffe seems to have been lecturing at Oxford, last November, on the Land question, and this *brochure* before us is a reply to his allegations and hypotheses. "I do beseech you" wrote Milton, "I do beseech you play upon this pipe." The Committee have played upon this Fyffe with a vengeance! The temptation to make extracts from their answer to him is very great, but we will not spoil the reader's pleasure even by the smallest anticipation of the treat he has before him in the perusal of the small volume which we heartily commend to him.

Magnetic and Electrical Laws. By E. HURREN HARDING. (London and Glasgow: Wm. Collins, Sons, & Co.)—There is a very large amount of information packed into this thin little tract on the subjects on which it treats; and it will, we should think, form a capital cram-book for examinees of the Science and Art Department.

Academy Sketches, including various Exhibitions. Edited by HENRY BLACKBURN. (London: W. H. Allen & Co. 1885.)—The exhibitions of the principal pictures of which illustrations are here given are the Royal Academy, the Grosvenor Gallery, the Royal Society of Painters in Water Colours, the Royal Institute of Painters in Water Colours, and the Society of British Artists. The illustrations vary from rough outline sketches to really artistic renderings worth preserving for their own sake. This volume must form a valuable souvenir of the works of our leading artists exhibited during the current year.

The Royal Academy Illustrated. Edited by HENRY LASSALLE. (London: Sampson Low, Marston, Searle, and Rivington. 1885.)—The reader whose acquaintance with the pictures of the year is, or is to be, limited to those in the Royal Academy, will find all that he needs, either as a guide during a visit, or as an aid to subsequent reminiscences, in Mr. Lassalle's work. As in the case of the volume previously noticed, the illustrations vary in artistic merit.

The Child's Pictorial, No. 2. (London: Society for Promoting Christian Knowledge. 1885); *The Little One's Own Coloured Picture Book, Nos.* 3, 4, and 5. (London: Dean & Son. 1885.)—The commendation which we bestowed upon the first numbers of the pretty and attractive coloured books for children, whose titles we have joined together above, may safely be extended to the parts before us. Both magazines sustain their original promise of beauty and interest for the small folk.

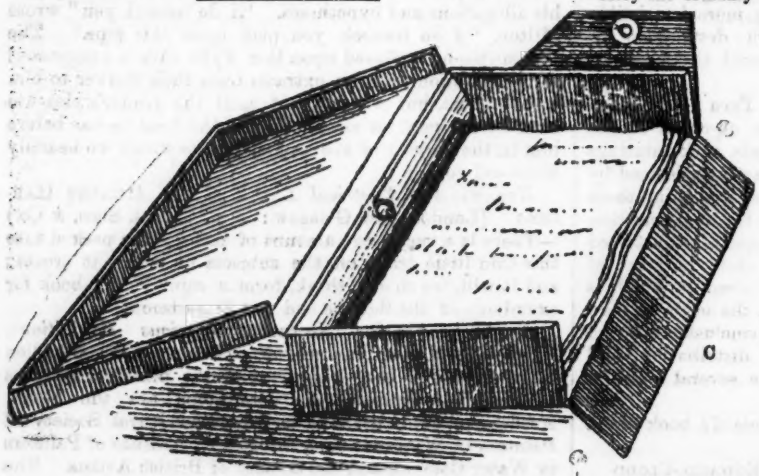
We have also on our table *Society, Bradstreet's, The Medical Press and Circular, The Christian Million* (with a report *in extenso* of an interview with Mr. H. M. Stanley, the African traveller), *Le Franklin, The Sanitary News, The Journal of Botany, The Tricyclist, Art and Dull Trade, The Ninety-fourth Annual Report of the Stirling's and Glasgow Library, Science,* and *The Proceedings of the Academy of Natural Sciences of Philadelphia.*

THE *Engineer* observes somewhat satirically that it is not true that the London, Chatham, and Dover Railway Company intends converting its second and third-class coaches into covered sheep-trucks at present.

XUM

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE being a popular magazine) than is accorded by the most excellent trade journals.



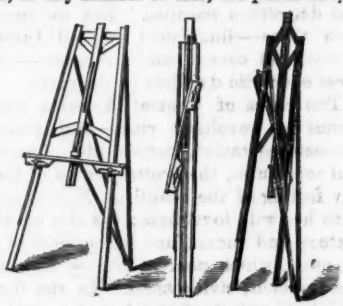
LETTER-FILE OR BINDER.

(Patent No. 5,102. 1884.)—The file illustrated has been patented by Mr. A. Blackwood, of 9, Manor-street, Ardwick, Manchester. It is intended for the reception of letters and other loose papers. It is made in box form, with a flange lid, keeping all papers placed therein clean, free from dust, and in order. A "binder," consisting of a piece of millboard, extends the whole length of the case, so that the smallest size of paper may be placed in the largest sized file and kept in position. The front, C, of the file, as soon as the lid is raised, falls down, giving easy access to refer to any paper, which can be taken out or replaced, or added to, without trouble or injury. The files may be made to hang up on wall, or book-shape, to stand on shelf. They are composed partly of wood and partly of millboard; they are covered with cloth or leather; a hinge is formed at the upper edge, and placed at the back of the file; an eyelet-hole is placed at each end of the clip or binder, at the lower edge, and two small rings are fixed in the back of the file in corresponding position to the eyelet-holes; a round or flat elastic band is passed through the holes and rings, and then tied, the effect of which is to bring the clip or binder firmly on the papers in the file and keep them in position. A jointed ring is placed in the binder, by which it is very easily raised. No damage to papers can occur, there being no spikes or anything that can injure or deface them.

The invention is practically designed, and should prove of great value to those wishing to preserve letters, &c. The fact of their being entirely covered up, and the means provided for hanging the file on a nail, are good recommendations.

THE HATHERLEY EASEL.

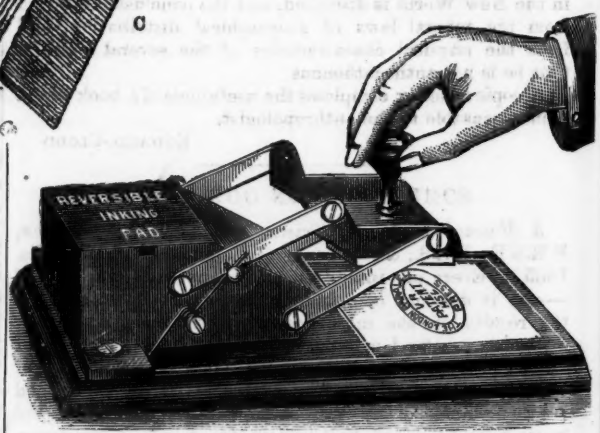
(Patent No. 8,602. 1884.)—This easel, patented by Mr. C. A. Jones, of Hatherley Court, Gloucester, has several features, of which the following are the chief. All three legs are connected together in such a manner as not to interfere with the opening and closing of the easel, and at the same time to prevent the possibility of accidental collapse. The width at the top, when open, enables a short easel to do the work of a much longer one of the ordinary kind. In all positions the easel is perfectly rigid. The ledge may be adjusted to a nicety at any height by means of a thumbscrew at either end, without the aid of holes or notches in the easel. The inclination can be adjusted by merely sliding the end of the stretcher-bar up or down the slot shown at the lower end of the central bar. The opening and closing is effected instantaneously by merely pulling apart or pressing together the two front legs. It is claimed to be the only folding easel which will stand firm on a polished floor without the aid of adjustable and complicated ties. The easel is exhibited at the Inventions Exhibition, in the East Gallery.



The Hatherley Easel.

PARALLEL ENDORSING PRESS.

(Patent No. 16,397. 1884.)—This invention, by Mr. Harold Savage, of Cheapside, London, E.C., has for its object the adaptation of the parallel press to carry movable type, which may be altered at pleasure to any required wording; to carry dates, numbers, or other movable pieces, in addition to any set wording which may form the ordinary die. The press will still carry the ordinary die, or any number of dies, the plates carrying



Parallel Endorsing Press.

the die being interchangeable. The pad is made reversible, so that the ink on one side being exhausted, it may be turned over and used without the trouble of re-inking. The press is provided with four guide-rods of sufficient length to admit of a die-plate about half an inch thick being secured to the top plate, and to allow the die-plate and die to fall fair on the pad. The die-plates are secured to the top plate by a screw fixed in the centre of the die-plate, this screw passing up through the central hole in the top plate, the handle is screwed on and the plate held secure; the side pieces, or flanges of the top plate, being a little lower than plate itself, ensure the die plate being held in a true line. For ordinary dies the plate is cast solid, or with a solid face. For carrying a date, or other movable pieces in addition to the ordinary die, a slot is cut in the die-plate, of a suitable size. For carrying movable types, the plate is so cut away as to leave a frame or "chase" only, into which the types may be set, and secured by means of screws, &c. The pad is made reversible; a metal plate, having two lugs or projections, is covered on both sides with cloth or felt. The pad is held in its place by the lugs, which fit into corresponding recesses cut into the flanges or sides of the pad bed.

The parts are all made interchangeable; the die-plate may be easily and quickly changed by unscrewing the handle; the plates may then be changed, and the handle screwed on again. The total weight is about 6½ lb., and the press appears capable of doing all that is said of it.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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THE RUDDY ECLIPSED MOON.

[1743]—As I cannot spare the time to discuss all the points raised by Mr. Proctor on this subject, I will only explain my own theory. I am surprised to find that he ever imagined for a moment that I supposed so monstrous an absurdity as a moon that is ruddy "with primæval heat," especially as he knows that I have expressed my scepticism concerning the existence of any such primæval heat, and the deductions concerning dying suns, cooling planets, youthful, middle-aged, and senile worlds that are based upon it. I even regard the nebular hypothesis, concerning which our astronomers of *to-day* are so cock-sure, as a very pretty mathematical dream, and nothing better. I do not deny it—such denial would be as unphilosophical as affirming it. My thesis is that human knowledge has fairly-defined limits; beyond these is the region of speculative folly—the blessed abode of transcendental mathematicians.

If a red-hot orb were "launched into space," as the fine writers have it, my conclusion is that, with a composition like that of the earth, its *surface* would cool down to a black heat in a week or less. The red heat, which I regard as a necessary consequence of the exposure of a tufaceous surface to unchecked solar radiation, must be of the most superficial character, and must be radiated away just as rapidly as absorbed.

As I explained in my second note on the subject (*Gentleman's Magazine*, November, 1884), the visibility of such red heat by us would depend upon the condition of our atmosphere. The twilight glows of 1884 indicated just the condition for intercepting and scattering the obscure red rays, and therefore the non-appearance of the ruddy glow on October 4th of that year is just what my theory demanded; while, on the other hand, the theory which Mr. Proctor defends demanded an unusual display of ruddiness at that period which "the poor thing," as Mr. Proctor says, failed to display. The same with the eclipse of March 30 (see KNOWLEDGE of last week, page 486). Instead of this failure telling against my explanation, and in favour of ruddy illumination by the solar rays modified by passing through our atmosphere, it affords a "crucial instance" in confirmation of my theory and refutation of his.

Prof. Langley's researches, as I read them, show reason for attributing a still higher temperature to the full moon than was previously justifiable. He has shown that our atmosphere cuts off more of the solar radiations than was formerly supposed, therefore the difference in favour of an airless globe must be proportionally greater.

Mr. Proctor makes much of the difference between the pencil of solar rays and the axis of that pencil, assuming, at the same time, that I do not understand this difference. I certainly do not understand how such difference can have any practical bearing on the subject, seeing that the diverging pencils of the solar rays have become practically parallel pencils before reaching the earth, and the difference between the axes of a parallel pencil and the pencil itself is zero—such a pencil is its own axis. It is quite true that my elementary optical studies are rather ancient—more than forty years old—and I do not know what treatment these pencils may have received at Cambridge in the meantime; but when I then dealt with them in the construction of optical instruments, they behaved as practically parallel by converging to the principal foci of our lenses and mirrors. If I am wrong, perhaps Mr. Proctor will set me right, by stating the amount of angular difference between the course of the axis of a pencil of solar rays as received on the earth, and that of the rays themselves on all sides of it—*i.e.* the amount of half their divergence.

I used the term focus according to its old-fashioned definition—viz., as "the point where the refracted rays or their prolongations meet," or "the point at or near which the rays of light are collected by a lens or mirror," and regarded the opaque earth with its surrounding atmosphere as a spherical spot-lens with a very large spot, and very low and variable index of refraction. Sir John Herschel does the same, but he used the words "convex lens of gradually-decreasing density." Such a lens has many foci, and illuminates an object placed anywhere between their limits accordingly. This is the case whether the pencils of rays refracted by it are parallel, converging, or, within certain limits, diverging.

W. MATTIEU WILLIAMS.

[1744]—I see that Mr. Mattieu Williams has suggested in your columns a theory with regard to the variation from one eclipse to another in the amount of the light and in the colour of the light which illuminates the dark body of the moon when it is immersed in the earth's shadow. It seems to me that the variation referred to is not due, as is usually assumed, to the presence or absence of clouds in the earth's atmosphere, but to differences of absorption in a higher region than that in which clouds usually float. We shall probably be much over the mark if we assume that the height of the cloud-layer which could obstruct the transmitted rays of the sun is as much as two miles. At such a height the atmospheric refraction would very appreciably bend the sun's rays into the earth's geometrical shadow. But the observed shadow into which the moon plunges always appears larger than the geometrical shadow which would be cast by a body as large as the earth not surrounded by an atmosphere. Mädler estimated this increase of diameter as 1-54th (see the "Astronomische Nachrichten," Vol. XV., p. 29.), and the English "Nautical Almanac" uses for the purpose of predictions the fraction 1-60th as representing the increase in the diameter of the observed shadow over the geometrical shadow.

More than one factor has to be taken into consideration in accounting for this increase, but it is evident that the lowest transmitted rays which correspond to the edge of the shadow region into which the moon plunges cannot be greatly refracted inwards by the earth's atmosphere.

It will be seen that refraction tends to decrease the area of the shadow. Absorption of light in the earth's atmosphere tends to dim down and tint with colour the inner zones of shadow and penumbra, and absorption of the solar light in the sun's atmosphere tends to increase the area of the observed shadow; for it decreases the brightness of the sun's light as you proceed from the centre of the disc towards the limb, so that the light derived from a crescent of the sun's disc is less than the light which would be given if the sun were uniformly bright.

The edge of the shadow thrown upon the moon is not perfectly sharp, but the transition from considerable brightness to comparative darkness does not occupy a minute of arc. It is evident that this region of sudden transition, which lies outside the geometrical shadow, must be illuminated by a solar crescent of sensible thickness, and that the greater part of the light which illuminates it must be transmitted through the earth's atmosphere at a height where the density of the air causes but little refraction. Celestial objects seen upon the horizon are raised upwards by refraction more than half a degree, consequently solar light which grazed the earth's surface at the sea-level would be refracted more than one degree within the geometrical shadow; but the geometrical shadow thrown at the distance of the moon is never two degrees in diameter—or to speak more correctly, the section at the moon's distance of the geometrical shadow thrown by the earth, never subtends two degrees as seen from the earth. Consequently, the whole shadow at the moon's distance would be illuminated if the light transmitted through the earth's atmosphere at the sea-level gave a perceptible illumination.

No doubt, the effects perceived during a lunar eclipse are greatly modified by contrast of light, but what the eye perceives is a somewhat sudden transition from bright light to darkness, and within the dark region on some occasions a nearly uniform reddish disc, and on other occasions a nearly uniform dark or bluish disc.

When the moon is centrally eclipsed, its limb is never much more than half a degree from the edge of the geometrical shadow or the region where the transition from light to darkness is so rapid, and its central portions are only about three-quarters of a degree from this region. Near to the centre of the moon at central eclipse the whole limb of the sun would be visible around the earth, but at other places the chief part of the illumination must be derived from light transmitted through the earth's atmosphere with the minimum of deflection. It is therefore evident that the chief part of the light which illuminates the lunar surface must have suffered a deflection of less than three-quarters of a degree in passing

through the earth's atmosphere. That is, it must have passed through the earth's atmosphere at a level above the region where clouds usually form. A. COWPER RANYARD.

THE PAST AND FUTURE OF THE EARTH AND MOON.

[1745]—Without wishing to contradict the probability that our moon may have had an extraneous origin, as your correspondent, "Hallyards," assumes in his letter (1712), may I ask does he really believe that its first appearance in our system falls within the traditional memory of man? He quotes an old Greek myth to the effect that the ancestors of the Arcadians inhabited a moonless earth, and considers the attempt to give a more rational explanation of the Greek text as unsatisfactory.

It is now generally admitted that the attraction of the moon is the main cause in producing ocean tides. Geology gives us numerous evidences of tidal action upon rocks and stone far anterior to the demonstrated age of man; the cliffs near Tunbridge Wells and those on the Linfield road to Brighton are notable instances; yet these, no doubt, are comparatively modern when compared with other formations.

Since "Hallyards" has brought an ancient legend to support his idea, by a legend let it be answered. Certain tribes of American Indians have a tradition which tells us their early ancestors paid occasional visits to the moon in times as remote (if the legend is to be credited) as those of the moonless Arcadians.

Will your correspondent explain the difference between a companion planet and a satellite? He says:—The moon is the only "companion planet," but admits that there are numerous "satellites." I have always understood that "planets" and "satellites" were interchangeable terms. For instance, our moon is our attendant "satellite," and it may be said of Jupiter and his moons, that they form a "planetary" system of themselves.

But to the more salient points of his letter. We are told that the blue colour of the atmosphere is due to the water it contains. This is a common enough supposition, but in my opinion none the less erroneous. The maximum amount of aqueous vapour which the air will hold in suspension, in the heat of summer, constitutes, roughly, about a fortieth of its entire weight; the weight of the atmosphere is only 15 lb. upon the square inch, equal to a column of water 32 ft. high. By dividing 32 ft. by 40 we shall readily see that the amount of aqueous vapour intervening between us and space would form considerably less than a foot of water, if condensed; a foot of water will not give a blue colour ("Hallyards" requires 16 ft.). Aqueous vapour intercepts light and gives opacity to the air, but does not give it colour. The colour must be due to either of its constituent gases. My individual opinion is that blue is the characteristic colour of oxygen ("Hallyards" thinks oxygen is red), just as chlorine is green, or bromine red.

"Since oxygen gives redness to the blood, it may be oxygen that makes Mars so very red." This argument is decidedly faulty. With the exception of weight, the properties of a chemical compound are not reflected upon its elements. If this is not clear to "Hallyards," let him take a solution of iron-perchloride, and another of potassic sulpho-cyanide; both of these are destitute of colour, but when mixed, a blood-red colour is produced. Each of the elements in their compounds assumes a variety of colours.

If we were to admit that the colour of Mars is due to an atmosphere of oxygen, our own atmosphere would be nearly as red—four-fifths of it being pure oxygen; at the same time "Hallyards" is content to believe that our earth would appear blue if viewed from Mars.

He speaks of "frozen" and "vaporised air"; this, to a chemist, is simply ridiculous, neither oxygen nor nitrogen is capable of assuming such a form.

He discredits the theory that the moon was once inhabited, because he can see no trace of human work upon its surface.

In a former passage he describes the persistency with which the human race would cling to life upon a dying world; the events which he believes will occur upon the earth in future ages may have already visited the moon, and the results, as seen upon its disc, are quite compatible with what we should expect in the decline of our own globe.

Is it not evident that in the desperate effort to maintain such an inclemental struggle—the death-struggle of our race—much, if not all, of the relics of our former greatness would be demolished? I think so. If not, it matters little; the destructive agents of the atmosphere are ever at work. In our changeable climate their ravages are too plainly discernible; if this is the work of a few centuries, what will occur in the extent of geological time yet to come? The human race will pass away; its very work will follow in the dim vista, slowly; but will the elements play their parts until chaos come again? ALEX. MACKIE.

THE FLOATING DOME OF THE NICE OBSERVATORY.

[1746]—It may be of interest to some of the readers of KNOWLEDGE to know that the immense dome intended for the Nice Observatory will not float in pure water, as I have somewhere seen it stated, but in a solution of chlorure of magnesium, which freezes only at 40° below zero centigrade. The dome measures inside 22m. 40, or 73 ft. 5⅛ in., and will contain a very large refractor of 18 mètres long, with an O.G. of 30 in. aperture, about receiving its finishing touch by MM. Henry, of the Paris Observatory, who has just finished their celebrated photographic refractor.

It is to be hoped that the generous founder of this observatory (M. Bischoffsheim) will still keep it independent of State supervision or intrigue, and not hand it over, as is stated his intention is, to the French Government when once all is finished.

WILLIAMS R. KENNAN.

INFINITE, GREAT AND SMALL.

[1747]—It was certainly Mr. Proctor who observed somewhere *obiter*, writing of space, "it cannot be infinite, for"—but then my memory fails me. I took particular notice of so decided an opinion put forth by so high an authority.

I foresaw your comment on my remark that we cannot conceive anything less than a mathematical point; and appreciate the collision between chemistry and mathematics. But what puzzles me is such a question as this. Take a disk whose perimeter is a true circle. The centre is a point. Can we conceive two ultimate atoms (not superposed) each occupying the true centre, each equidistant from every part of the perimeter? If not, I do not see how an atom can be infinitely divisible; *i.e.* Position seems to me to collide, at last, with dimension. HALLYARDS.

MATTER FOR REFLECTION.

[1748]—The "clock and mirror" puzzle seems to be only a new view of our old friend, the "angle of incidence" and the "angle of reflection." Observant reviewers know the perils which environ the innocent lady-novelist who meddles with any "mirror" but her own. The workings of the villain's countenance, and the triumphant hatred gleaming in his eyes, are watched by the hero, *himself screened from observation*, behind a friendly door. Probably a less obvious optical difficulty may find its solution in the same law. Not only the eye of a portrait, but the painted line of moonlight on water, appears to follow the spectator as he moves. "I can do it," an artist once replied to my question, "but I cannot tell you how it is done." Q. T. V.

IS "IMMORTALITY" A FICTION?

[1749]—At one of the May Meetings it was stated that one chief cause of the success of the Indian Mission was that "delicate, highly-educated English ladies (magic word!) left all the comforts of their English home for the work"—let us say, applying *the* poet's heavenly language, to "dedicate their beauty to the sun" (of Righteousness).

Then yet a little while ago we saw a portent—Captains of the Universities Eleven and Eight—going out to China, Bible in hand, to proselytise. I could not help thinking, this is not fair! Let them at least take their Darwin in the other. (We know how the Zulus gravel'd poor Bishop Colenso!)

Nevertheless, though I argue thus, I cannot express my sense, especially at times, of unfathomable (horizontally, without end), dismal hopelessness—nay, despair—if we are to conclude, after all, that the doctrine of immortality is all a farce; that Cordelia is to be hurried after a spasm of time into the hideous grave, to rot! Those homes of soul, her eyes ("heavenly orbs," indeed!); those lips, too pure and royal to be kissed by the best and greatest among men, to be gnaw'd and digested by worms! "Horrible, horrible, horrible!"*

Yet the gravitation of scientific opinion seems to tend to the positive, absolute denial of immortality. Is not the prospect almost appalling if this denial shall become the world belief (or disbelief)? What shall we do with our churches, our cathedrals, all this world-wide fabric of Christianity?

Does it not seem that the doctrine of immortality—human immortality, not the (undeniable) belief of the immortality of the power of the I AM behind the masks of all—does it not seem that this eternally comfortable doctrine, to us pilgrims and caravan-journeyers through the vale of tears is alone worthy of our cathedrals? You may say (I doubt you, Mr. Editor, are of the novelist George Eliot's opinion †), Let the churches and cathedrals become

* Cheers for Cremation! † Guess again.—ED.

schools and music sanctuaries. Music, indeed, is alone worthy to replace the Belief; but music itself, let alone science, *mere* knowledge (facts, facts, facts, or fragments of facts and hypotheses for a spasm of tissue). What is even music (*e.g.*, the Mass in D, and 9th Symphony) without the soul of music—immortality?

Is there, Mr. Editor—is there not any prospect of the doctrine being scientifically proved? You flout and scout apparitions and the phenomena of the Psychical Society, but may we not look for comfort in that quarter?

On the other hand, how is it that our terrific army and apparatus of clergy, and religion continue utterly, stolidly, grossly unmoved by modern science and denial; by Schopenhauer and Darwin? If they are honest they dare not send the Bible to "the heathen" in one hand without sending Darwin in the other. When *will* they cease their frightfully old-fashioned dead-dog cant and clerical Billingsgate about "infidelity." The word now is nothing but tinkling brass and a sounding cymbal. It is the insult of spasmodic impotence (like our prodigious Government's "policy"!). I utterly scorn and detest it. At the same time, though I (mentally) kick and abominate dogma (she herself, the hideous witch which burnt poor old women and Giordano Bruno; tormented Galileo), I yearn to see the belief in immortality *proved*. Without it we do indeed feel the melancholy force of the words, "without God in the world."

COMMENTATOR.

IS DARWINISM DOUBTFUL?

[1750]—I am pleased to think that your veteran correspondent, "Hallyards," and myself, if I may say so, would make good and true allies. I, like him and the Darwinians, repudiate "separate creation" (in the crude imagination and vulgar sense of the "isms" and "anities"—insanities!), but I am by no means so "cock-sure" (gentle ladies, pardon the slang) as the "Selectionarians" that we know all about it. I was looking at a worm the other day, and I could not help reflecting: Now, is it not monstrous to assert that the worm "*acquired*" (O Shibboleth!) its softness and shape, so admirably fitting it to burrow into the soft earth; that the worm began by being hard, but, by-and-by, lo! one (or many at once?—Darwin does not tackle this) HAPPENED to "vary" into a modicum of softness, and——you know the rest of the Selectionarian formula!

Has not "Hallyards" hit upon one all-important factor in the problem?—viz., fecundity; and has not Darwin himself (as I said before, I love and honour him—so we do all!) strangely lost sight of this, as a Conservative? He speaks of it as a Malthusian, but it, just it, may, as "Hallyards" points out, be the very device by which, in the struggle for existence, species are preserved. The lonely philosopher of the New World says "flights of painted moths are as old as the Alleghanies."

Then, again (a most cardinal point!), gradations (Darwin's principle of principles, feature of features) co-exist—the short whale with the long one, the worm with the boa-constrictor, &c., *ad infinitum*.

May it not be—this is what I feel—thus? There *is* a struggle, but not so much for existence as for superfluous or excessive existence. The excess are cut off, but, on the whole, there is room for all. (Not a sparrow falleth, &c.) I must say that I, "whene'er I take my walks abroad," am *not* struck by destruction, but *am* struck by conservation. The lizard, the butterfly, the worm, and the million other *dramatis personæ* of "all the world a stage," keep on, and have kept on, co-existing (from the speck of jelly upwards), earthly speaking, "from everlasting to everlasting!"

Small, timid apes hold their own now, like so many more creatures, simply by escaping (curious in this world how there seems always some hole to escape into!) and multiplying according to law (*what* that law is not even Darwin has made manifest).

I agree with "Hallyards" (I am sorry to be discourteous) that your accomplished lady contributors seem to confound cause and effect. *That* is *the* question!

COMMENTATOR.

EVOLUTION.

[1751]—I fear "Commentator" (letter 1728) is merely tilting at windmills, for certainly no writer in KNOWLEDGE has ever represented the development theory as "*selected haphazard variation!*" He also complains that "Miss Ballin, Miss Naden, and others assume development, 'now in one way, now in another' . . . . begging the question." It is a very convenient method of exposition, first to state (or assume) the thesis, and then to bring forward evidence in support of it. This is what the writers in question do.

On the other hand, "Commentator" *assumes* that "nature" is the "predestined development of infinite reason;" and not only does he *leave the assumption unsupported by evidence*, but what he propounds is *absolutely unthinkable*. It obviously involves a contradiction to assign intellectual qualities to the Unknowable Agency that underlies phenomena. (See Herbert Spencer's admirable article in the *Nineteenth Century* for January of last year.)

Moral:—"First cast out the beam out of thine own eye; and then shalt thou see clearly to cast out the mote out of thy brother's eye."

T. COMMON.

INSTINCT OR REASON.

[1752]—A near relative of mine has a small fox-terrier, one of the cleverest of her clever kind, known as "Teenie." A few weeks since a little kitten was brought into the house with which two young children used to play. On one occasion this kitten was at the top of a flight of stairs, and the children were at the bottom calling to it to come down to them, but it did not understand them. Teenie, coming out of a room into the hall, took in the situation at a glance, and running up the stairs, she picked up the kitten by the neck and trotted down with it to the children and placed it on the ground before them.

A few days afterwards this kitten was scratching and clawing, in play, at the feet of one of the children under the table. The child's mother scolded the kitten for doing so; in an instant Teenie dashed under the table, seized the offending kitten by the neck, ran across the room with it, and threw it into the fender almost under the grate.

No orders had been given to the dog on either of these occasions, nor had its name been mentioned or any notice been taken of it.

JOHN BROWNING.

DOUBLE CONSCIOUSNESS.

[1753]—I must again enter my protest against the expression *double consciousness*. Mr. Proctor in his article on Thought Reading, says:—"My wife's second consciousness, the mind and will belonging to the ordinarily inactive half of the cerebrum, may quite actively have directed the planchette's career and *quite unconsciously to herself*." The italics are mine. Surely this is a contradiction in itself. I am quite willing to admit the double brain theory, but it seems to me as soon as the ordinarily inactive half of the cerebrum is capable of conscious thought, the consciousness, which is the result, is the ordinary consciousness. Why should not the brain reason unconsciously? What has consciousness to do with accuracy of reasoning, or even with the conversion of reasoning into articulate speech? I once stated, in a letter to KNOWLEDGE, that I was unconscious for a quarter of an hour, during which time I conversed rationally. One of your correspondents replied that, if I was unconscious I could not have talked rationally, and that if I talked rationally I could not have been unconscious. I maintain I was unconscious. In this matter I am sole judge, and my friends say I made use of articulate speech more or less grammatically. I imagine the process of articulating sounds is quite as complicated a brain process as forming a syllogism. I am, nevertheless, rather inclined to agree with Mr. Proctor that an unconscious process of reasoning is the explanation of thought reading, but probably many of our conclusions are arrived at in precisely the same way. For instance, there is a clock on the mantelpiece in front of me. I raise my eyes from the paper on which I am writing, and take a hasty glance at it, and note the time as 1h. 45m. My little boy, aged five, comes into the room, and I ask him what time it is. He takes time to consider, notices the small hand at 2 and the large hand at 9, and says a quarter to 2. Now, the question is, has my brain worked out quickly and unconsciously this problem; or have I a thought in my brain corresponding to every position of the hands of the clock, the sight of which spontaneously produces the thought? Does not this rather tend to show that unconscious thought is the result of practice, and is more likely to be the product of the active half of the cerebrum than the inactive one? For instance, take the ordinary case of two people commencing a similar sentence at the same moment, on a subject which was not under discussion. The only possible explanation seems to be that something has unconsciously drawn the attention of each simultaneously to the subject. But in any case does the second consciousness in any way simplify matters? According to Mr. Proctor's view, the second consciousness imbibes the idea unconsciously, and then communicates the idea to the first consciousness. Surely this is a case of the world supported by an elephant, the elephant standing on a tortoise, and the tortoise on nothing. Supposing two consciousnesses in one person—how do these two communicate with one another any more easily than the two consciousnesses of separate persons? I cannot see what grounds there are for supposing that in the hypnotic state it is the ordinarily inactive half of the cerebrum working to the exclusion of the other half. How is it, for instance, that persons in the hypnotic state are able to speak? It is almost an undisputed fact that the faculty of speech resides in the left half of the brain. To acquire speech is a long and difficult process.

How is it that persons, whose whole life passed in the hypnotic state may be measured by a few weeks at the outside, are able to carry on a conversation?

There is a class of phenomena which seems to bear on the question. For instance, I have an appointment at noon. About half-past eleven I am walking conversing with a friend, and take out my watch and look at it. My friend asks me the time, and I reply by again taking out my watch to see. There is no hypnotism in such a case, I imagine. Is not the explanation this? My attention is just a little divided. I am listening to my friend's conversation and following it; at the same time I am nervous about missing my appointment. I look at my watch, and at once see I have plenty of time, but notice no more. Here is another case somewhat similar. I am a schoolmaster looking over a boy's exercise; another boy suddenly asks me "what is 5 times 4, sir." I answer immediately 20. In a few seconds I say, "What did you ask me?" All I am conscious of is that I have answered something, but I feel sure the inactive half of my cerebrum has not advanced as far as this in its multiplication table, and, as a matter of fact, I have answered very advanced questions in a similar manner, questions the answer of which I have had to check on paper. For the present, I must here leave the subject, but I hope to return to it.

JOS. W. ALEXANDER.

CUCKOOS.

[1754]—I have not at Pornic heard the cuckoo more or less than usual: but I never heard fewer nightingales: and was wondering the other day if they knew it would be so cold here, and had stopped short on the road.

You cite a rhymed proverb which should be thus:

"In April
Come he will:
He in May
Sings all day."

So "least said soonest mended" arose when we pronounced otherwise—

"Leäst sayèd
Soonèst mendèd." HALLYARDS.

COSMICAL MOVEMENTS.

[1755]—"Hallyards" in letter 1723, cannot conceive how a star, journeying through space, can avoid an orbit, The Law of Gravity, he considers, demands,—that the nearest larger body must exert a certain pull, which, however slight, must be sufficient to give a curvature to its progression, which means eventually, a circular or elliptical orbit, In other words: he doubts the possibility of a star to travel in a straight line. The whole question, I think, yields to a very simple explanation. In practical astronomy, our capacity to discriminate finely between a curved, and a straight line is limited. In the first place: the orbit of a globe may be so large, that all possible investigations are confined to the consideration of merely a small portion of its course. For example—Our sun and its entire system, according to recent observations are travelling *en masse*, towards a particular point in the constellation Hercules. Whether this direction proceeds in a straight line, or whether it forms a small portion of a gigantic revolution, cannot be ascertained, because of the magnitude of the subject, and the enormous lapse of time which would be requisite to make decisive calculations. In the second place: Since the ellipse of orbits vary greatly in length and breadth, it is not only possible, but probable, than an orbit may be so narrow in it's ellipse that it will be found impossible to distinguish it from a straight line, If we suppose an ideal system, in which a sidereal body passes at right angles, between two larger bodies, these latter being of equal weight, equidistant from the first, and having motions so balanced, that the attraction felt by the interloper is equal on either hand, this intermediate body, would move in a straight line, with progressive and retrogade motions, we are not warranted in assuming, that even in the vast magnitude of the universe such a delicate adjustment *does* exist, a single grain of sand added to either of the larger bodies, would actually give the central orb a curved motion (in proportion to the weight added) but—how could we guage the curvature.

Your correspondent's idea, that gravity and other kindred forces may act only within certain bounds reminds me of the old paradox of Achilles and the tortoise:—The warlike "son of Peleus," we are told, once started in pursuit of a tortoise, and, although, by travelling twice as fast as the slow-paced reptile, he succeeded in *halving the distance between them* at the end of every second, he was never able to overtake it, Truly: neither Achilles nor the tortoise could attain a distance twice that which seperated them at the start.

"The strongest magnet will not attract the smallest particles of Iron beyond certain limits" on what does he base this conclusion? at what distance is the compass needle unaffected by the poles?

Many scientific men are of the opinion that the regions of space are traversed by magnetic currents, and there is much evidence to support this theory; Variations of the compass-needle coincide with disturbances in the solar orb, and the phenomena of light itself are believed by many to be associated with magnetism.

ALEX. MACKIE.

[I print Mr. Mackie's letter just as it stands. His dynamics are a little funny in connection with the body approaching the centre of gravity of a system of two great orbs.—ED.]

"THE PURE WELL OF ENGLISH UNDEFILED."

[1756]—I regret that you should have given the sanction of your approval to the present fashionable affectation of placing the article "an" before an aspirated "h." It may be possibly easier to pronounce than "a," but is none the less a defiance of one of the primary rules of English grammar. What a pity it is that just when the defective sounding of "h" is beginning to be in a fair way of being remedied, educated men should arbitrarily introduce a fresh stumbling-block! If only our reformers would adopt as their basis increased "consistency" in the language, how easily would its simplification come about. There is no reason whatever why the "h" should not be sounded in every word in the language except when it is impossible, namely, in the four words, hour, heir, honour, and honest, and even in these, public opinion might be educated to aspirate them.

With consistence as the chief aim, other similar reforms would soon follow. The unpronounceable "employé" and "envelope" would give place to "employee" and "envelope," while even "attaché" and "fiancé" might in time be Anglicised.

"Acoustics" would give way to "acustics," "cainozoic" to "cœnozoic" or "cenozoic," and "schism" and "schedule" would be pronounced as spelt—*i.e.*, like scheme.

Any number of other alterations equally easy, and only requiring an established criterion, would also follow, and I trust your influence will in future be used to help them on.

E. A. PHIPSON.

"EASE 'ER—STOP 'ER."

[1757]—In my letter "Ultra-Gas" p. 465, there is, strange to say, only one misprint—in spite of very bad writing—but that one is a crusher. I wrote "in certain cases there is now attraction, now *repulsion*." This must have seemed impossible English to your compositor, or corrector; so he substitutes "*no*" for the first *now*, and *nor* for the second. Your readers must have been puzzled.

"Was that one of David's psalms, John?" said the parson to the clerk. "No, indeed, sir—a something better than *David*—'twas a piece of my own."

There are several in "Beast-Language" p. 466, as "mere-pork" for "more-pork," "ever" for "even"; but the worst crime of proof-readers is the arrogant alteration of stops. There is not one person in five hundred that can punctuate a common private letter, either in England or France; and I claim to be of the minority. Punctuation is not yet six centuries old, and is a very doubtful good, since even authorities differ on it. Lawyers never punctuate, holding that the sense of an instrument depends entirely on the words. Still, stops are a great help in reading; but then they should be logically used. I wrote "The katy-did is another example, from the insect world." Had I not wished to be as brief as possible, I should have written "*this time taken from*," &c. I economised space by omitting those words and placing a comma. This your printer omits, thus making nonsense, because it was *the only* example from the insect-world which I cited. Again, I wrote, "Surely the first called *barbaroi* must have," &c. This is defiled by commas so placed as to make me say that the first (men?) were called *barbaroi*. There are other stops powdered quite wrongly over what I wrote; but these I omit, since they only seem to show me ignorant, and not absolutely irrational.

Misprints easily corrigible by readers may be safely left alone but there is one in my letter (1721) "you, Sir, exorcised this as trenching on theology." This may engender the erroneous notion that you salute all orthodoxy with a "Vade retro, Satana" and sprinkle it with holy water—(water is the base of ink): even as those Parisian lunatics, the new *Antideists*, who proscribe God to the extent of fining each other for saying "Adieu!"

I had written "excised"—"cut out" would have been better. I do not think *excise* is English in that sense; *incise* is; but *decido* makes *decide*. HALLYARDS.

P.S.—Some (*e.g.* Leibnitz) hold that matter can exist without extension. If so, there is nothing impossible in the christian dogma of the pleni-presence of Christ's body. This, I thought,—a matter of pure fact—could regularly be discussed in KNOWLEDGE. —H.

LETTERS RECEIVED AND SHORT ANSWERS.

MISS KATE H. CHANDLER. Undoubtedly the Ammoniaphone is in the market, but I really do not know where it is sold myself. Write to any high-class London music-sellers—Keith & Prowse, or the like. —W. JACKSON. Streeter, the Bond-street jeweller, wrote a book on "Precious Stones," which ought to answer your purpose.—J. M. B. It would really appear from your letter that the cuckoos must have held a species of convocation about Dorking. If this be so, it may to some extent account for their conspicuous absence from—or silence in—other parts in the South of England during the month just past.—DR. BARNARDO. An important engagement on Epsom Downs on Wednesday precluded the possibility of my availing myself of the invitation with which you kindly favoured me. —H. B. Is v. 8 really one whit more genuine than v. 7? To ask *why* water crystallises at an angle of 60° is to put an idle question. No true student of Science ever pretends to attempt to penetrate to final causes.—SENEX. presumably the reviewer considered that all who would read his essay would be tolerably familiar with the results of modern criticism. I do not feel personally justified in inviting him to repeat a notorious fact in any form of words whatever.—G. M. L. It would be a simple impertinence to suppose that the reviewer was ignorant of Dr. Lightfoot's essay. With regard to your second point, see reply to "H. B." above.—AUG. J. HARVEY. Probably owing to my own mental infirmity, I fail to follow you in your argument that if we had always been accustomed to mesmerise ourselves "insanity, consumption, cancer, and other diseases would never have to take root."—DR. LEWINS. Intellectually constituted as are the overwhelming proportion of mankind, your theory would fall upon but barren ground indeed, were I to proclaim it as persistently and prominently as you continue to urge me to do. To give a single illustration why: I trust to you not to mention it, but in strict confidence I may tell you that I was at the Derby on Wednesday week, and, *inter alia*, saw a gentleman on the course who had had a fight with another gentleman, with the result that the first gentleman's nose was bleeding copiously. Now, it strikes me that the fist of his antagonist had a very objective existence indeed for him, and that had I (of course, at the risk of having my own head punched) assured him that his unpleasant condition was wholly subjective, and had its beginning and ending in his "Ego," he might have doubted my sanity, had he done nothing worse.—GENERAL BABBAGE points out that the entire sum spent by the Government in connection with calculating machines went in the construction of the Difference Engine, and that the late Charles Babbage developed the *Analytical Engine* entirely at his own cost and charge. Whether the country ever obtained anything in the slightest degree equivalent for the very considerable sum expended from the National Exchequer is a point on which General Babbage and I must agree to differ.—J. CLIFFORD WILLIAMSON. I know nothing whatever of the address of the maker of the "Hand-grenade Fire-extinguisher." —H. R. SHARMAN. Received with thanks.—HALLYARDS. If I "have fetched a lusty blow," &c., it was done unintentionally. I am not in the least a man to "cry stinking fish," which I should assuredly have done had I fetched the blow in question. I entirely agree with the spirit of your letter, even if I do not insert it.—COMMENTATOR. Letters will appear. Thanks for very picturesque photograph.—SENEX. As there is really nothing in the very interesting account you send which might not with advantage appear in print, why not ask the author's permission to publish it?

THE following paragraph, which has gone the rounds of the papers this week, forms a fitting sequel to our article in No. 186 on "Overhead Electric Wires"—"The Press Association states that the Government do not intend to follow up the recent report of the Select Committee on Overhead Wires by any legislation, considering that the recommendations passed by the majority of the Committee were impracticable, and would invade private rights to an extent for which the Government cannot make themselves responsible." And the following extract from the *Electrical Review* is typical of many notes which have appeared during the past five years or so, and forms a striking comment on the assertion that the danger from overhead electric wires is very small, and has been greatly exaggerated:—"A telephone lineman had a painful experience the other day at Philadelphia. He was on a pole, tightening wires, and imagining that in the daytime the electric light wires were free from danger, he caught hold of one, the result being that he received a shock which rendered him insensible. He hung on to the wire until his fingers were badly burned, when he fell and was caught on a wire by the strap of his climbers. He remained suspended in the air, head down, for several minutes, when he was rescued and taken to a hospital, where he was restored to consciousness. One finger was burned entirely off, and another and the thumb were amputated."

Our Whist Column.

BY FIVE OF CLUBS.

REASONS FOR THE ACCEPTED ACE LEADS.

FROM a long suit, or in the case of a forced lead from three cards, headed by Ace, Ace is only played in two cases, viz., from Ace to Five at least, not including the King, and from Ace, Queen, Knave, with or without others.

It is easy to see why Ace should be led, as a rule, from Ace with four more cards. The objects of the play from a long suit are first to make as many tricks as possible in the suit, and secondly to establish the suit. Now, if a small card is led from a five-card suit there is a considerable chance that the Ace will be ruffed. The odds are, indeed, in favour of the suit going round twice. If the reader is very anxious to know what the chances are, let him rejoice in the following statement:—There are 290,884,898,304 possible ways in which the cards of a suit may be so arranged that one player has five, and there are only two kinds of arrangement by which one player holding five, each of the others may hold two at least, viz., by the remaining eight cards lying 3, 3, 2 in the other hands, or 4, 2, 2. Now the actual number of ways in which the former arrangement can be obtained is 98,534,079,072; while the other arrangement can be obtained in 67,182,326,640 ways; hence the arrangements by which all the three other players will hold at least two cards of the suit are 165,716,405,712 in all, or considerably more than half the total number of arrangements possible. Moreover, of the remaining arrangements, by which the suit will run shorter than two cards in one of the other hands at least, nearly one-third put the short suit in partner's hand, who would not ruff. The arrangements by which the other eight cards are distributed in the other hands, so that one hand has less than two, are: First, 4, 3, 1, in the other hands, which can happen in 82,111,732,560 different ways; secondly, 5, 2, 1, which can happen in 20,154,697,992 ways; thirdly, 4, 4, 0, which can happen in 7,895,358,900 ways; fourthly, 5, 3, 0, which can happen in 5,684,658,408 ways; and lastly, 6, 2, 0, which can happen in 4,134,297,014 ways. One-third of these cases, which amount to 119,980,744,874 in all, are favourable. The remaining cases, of course, viz., where the eight cards are distributed 6, 1, 1, or 7, 1, 0, or 8, 0, 0, in the other hands are all unfavourable, they amount severally to 4,478,821,674, to 689,049,504, and to 17,876,428. Adding these three sets to two-thirds of the preceding five sets, we get 85,172,910,922 unfavourable cases in all, or less than one unfavourable case in three. Yet the chance which exists that the Ace will be ruffed in nearly one case out of three is too great to be unnecessarily risked. By leading the Ace at once, and then a small card, the Ace is almost certain to be made, and there is a good chance of so far exhausting the suit that either the command will remain with the original leader, or a third round taken out by partner will leave him with two long cards in the suit, which, when trumps are extracted, will be as good as trumps, or may be effectively employed in forcing out trumps.

The lead from Ace to Ace, Queen, Knave, with or without others, is obviously good; for after the Ace has made, one or other of the Queen-Knave sequence can be led, forcing out the King, and then the suit remains in all probability established. If partner holds the King guarded, he would probably not play it on the Queen, unless he saw that it was absolutely essential he should give his partner the chance of leading the Knave, when he would take the trick with the King and lead the little card. Usually, however, he would refrain from taking his partner's trick; and thus if the leader had originally five cards in the suit, his long suit would be blocked. To avoid this it is customary to lead the Knave from the Queen-Knave sequence, after Ace has made, when the suit was originally Ace, Queen, Knave, and two others at least. Then partner puts on the King, and the long suit is practically established. Of course, if beside the Queen and Knave, the leader holds the Ten, he leads that card instead of the Knave, where he originally held five, the Queen, however, if he only held the Ace, Queen, Knave, and Ten. The principle is obvious, though it may be remarked that many players doubt the wisdom of the convention by which Knave, or lowest of Queen-Knave sequence, follows the Ace when the original hand contained more than four cards. Cavendish was led to suggest the innovation by observing the bad effect of his own play on one occasion when, as partner to a player who followed Ace by Queen, he played his King's solitary guard to the Queen, and had then to capture the Knave without any power of giving his partner a lead again, by which the two long cards in the suit would have been available for two tricks certain.

XUM

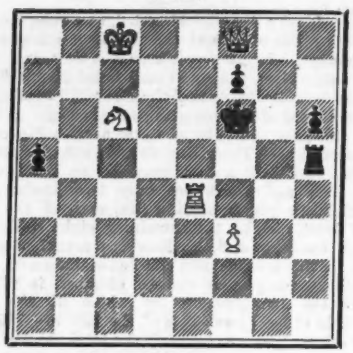
Our Chess Column.

By MEPHISTO.

PROBLEM No. 158.

By B. G. LAWS.

BLACK.



WHITE.

White to play and mate in three moves.

NOTE.—Problem No. 157, White to play and mate in three moves.

AN amusing skirmish, which was recently played :—

IRREGULAR DEFENCE IN THE ALGAIER GAMBIT.

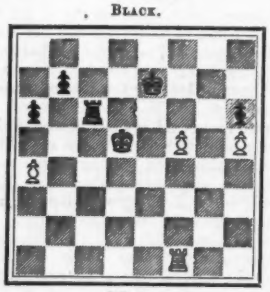
White. A.	Black. B.	White. A.	Black. B.
1. P to K4	P to K4	10. B × P	P × KP
2. P to KB4	P × P	11. Castles	Q to Q2
3. Kt to KB3	P to KKt4	12. Kt × P	P × P
4. P to KR4	P to Kt5	13. B to B4	Q to K sq.
5. Kt to Kt5	P to Q4	14. B to Q6 (ch)	K to Q sq.
6. P to Q4	P to KB3	15. B to B7 (ch)	K to K2
7. Kt to R3	P × Kt	16. Q to K2	K to Q2
8. Q to R5 (ch)	K to K2	17. Kt to B5 (ch)	Resigns
9. Kt to B3	P to B3		

ENDING FROM ACTUAL PLAY.

The following position occurred in a game played at the City of London Chess Club. Black having given the odds of Pawn and move. White played 1. R to K sq. (ch), K to B sq. This move illustrates the great importance of timing the moves in End-games. Either K to B2 or B3 would be less good, i.e., K to B3. 2. R to K6 (ch), and whether Black plays R × R or K × P White wins, for if K × P White Queens in eight moves, while Black wants nine moves. Or if R × R, 3. P × R, K to K2. 4. P to R5, and wins. Again, if Black replies K to B2, then 2. R to K6 likewise gives White an advantage, although barely sufficient to win.

J. GUNSBERG.

BLACK.



WHITE.

A. HOOKE.

After 1. R to K sq. (ch), K to B sq., the game proceeded: 2. R to K6, R × R. 3. P × R, P to Kt4. 4. K to Q6, K to K sq. 5. P × P, P × P. 6. K to B5, K to K2. 7. K × P, K × P. 8. K to B4, K to B4. 9. K to Q3, K to Kt4. 10. K to K2, K × P. 11. K to B3, K to R5. 12. K to Kt2, and the game is drawn.

The following is also an instructive variation :—1. R to K sq. (ch), K to B3. 2. R to K6 (ch), K × P. 3. R × R, P × R (ch). 4. K × P, K to K3. 5. K to Kt6, K to Q4. 6. K × P, K to B4. 7. K to R5, K to B3. 8. K to Kt4, K to Kt3. 9. K to B4, and again White must Queen his KRP.

NOTHING NEW UNDER THE SUN.

THE following note from "Skrani" appears to be of some interest: — In the American "Synopsis," appears the "Stonewall" Opening, the moves being 1. P to Q4, P to Q4. 2. P to KB4, P to K3. 3. Kt to KB3, Kt to KB3. 4. P to K3, &c. This is so far from being a novelty that I find it, with the first two moves of White transposed, in several of the De la Bourdonnais-MacDonnell games, the former master playing the attack.

In the same book "Bird's attack" in the Giuoco Piano occurs, the Frenchman being again the experimentalist, but losing. I also discover here one of Mr. Mason's favourite developments, viz., 1. P to Q4, P to Q4. 2. B to B4, which, if my memory serves me, was stated by so good an authority as the *Field* to have been introduced by Harrwitz. I also think I remember that the Opening 1. Kt to KB3 which I call (and I think rightly) the Zukertort Opening (for he it was who made it workable in first class practice) was described by the same authority, as the invention of one of the players in the Paris Tournament of 1867. It will, however, be found in an important match game so far back as 1851, Mr. Staunton being the aggressor, and Mr. Williams the defendant. See "Chess Tournament," page 152, for the moves, 1. Kt to KB3, P to Q4. 2. P to Q4, P to K3. 3. P to QB4, P to QB4. 4. P to K3, Kt to KB3. 5. Kt to QB3, Kt to QB3. 6. B to K2, &c. Truly the ancients have stolen all our best thoughts! Perhaps someone can carry these moves even further back.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

E. LOUDEN, H. A. NISBET.—Solutions of Problem No. 157 corect.

E. W. YOUNG.—To refuse to take the P after White's seventh move, P to K5 in the Muzio Gambit, has often been played, but with less success for Black than Q × P. If Q to B4 instead, White replies with 8. Kt to B3 (threatening Kt to K4 and B6). If Black replies with QKt to B3. 9. Kt to Q5, Kt × QP. 10. Kt. × P (ch), K to Q sq. 11. Q to B3, and Black has an awkward position. We should, however, be pleased to publish your analysis.

AN exhibition of machinery and appliances used in mining operations will be held in Glasgow in September, towards which a guarantee fund of £500 has been promised.

IMPORTATION OF INFECTIOUS DISEASE INTO LONDON.—Vigorous steps are being taken to prevent the introduction of infectious disease into London by the waterway of the metropolis. The Port Sanitary Authority has recently drawn up stringent regulations regarding the method of arresting the importation of eight specified diseases, and these have been approved of by the Local Government Board. Every person in charge of a ship having dangerous infectious disorder on board is to stop at Gravesend, and send notice to the medical officer of the Port Sanitary Authority. The ship is to remain moored until she has been boarded by the medical officer, who shall, if necessary, order the removal of the patient to one of the hospitals of the Port Authority. Similarly, if disease breaks out after passing Gravesend, the person in charge of the ship is to give notice to the Port Authorities at Greenwich, who are to follow a similar course. Masters of ships who fail to comply with their order are to be fined £5. We commend these simple regulations as admirable substitutes for quarantine.—*Medical Press and Circular.*

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